

Appendix (for Online Publication) to

Sudden Stops, Productivity, and the Exchange Rate

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A Aggregate Data

A.1 Data Sources

Annual data on the current and capital accounts for all available countries comes from the IMF's International Financial Statistics Database (IFS) for the period 1990-2015 and complemented with data on GDP per capita growth from the World Bank's World Development Indicators Database.¹

To characterize the macroeconomic dynamics during a sudden stop, I assemble data on output, final private consumption, employment, wages, total factor productivity (TFP), exports, imports, the current account deficit, and the real exchange rate. Output, consumption, exports, and imports are drawn from the World Development Indicators; TFP and employment from the Conference Board Total Economy Database; the current account deficit from the World Economic Outlook Database; and the real exchange rate from the Bruegel-Darvas real effective exchange rate database, an index for which an increase denotes a real appreciation. In the event study I normalize this index to 100 in the year before the onset, so that a decline measures a real depreciation; the depreciation figures quoted in the text are the average trough decline relative to that base.

Employment is measured in hours worked, the product of persons employed and average annual hours, both from the Total Economy Database. Since consistent cross-country wage series are not available, I proxy the wage by labor compensation per worker: the labor compensation share of GDP (Total Economy Database) times nominal GDP (World Development Indicators), divided by the number of persons employed. The resulting wage is therefore nominal.

A.2 Identifying Sudden Stops: Algorithm

The following algorithm combines elements of [Calvo, Izquierdo and Mejía \(2004\)](#) and [Cavallo and Frankel \(2008\)](#).

- Use IMF Balance of Payments annual data for all available countries in the period 1980–2015; episodes are retained if they start in 1990 or later.
- Drop (i) small countries - in terms of population (below 1 million inhabitants) and in terms of wealth (below 1 billion USD); (ii) countries with incomplete time series.
- Compute year-to-year changes in the financial account.
- Compute rolling averages and standard deviations of the change in the financial account with a window length equal to ten years. Check that at least 60% of the observations in the window are available, otherwise set to missing.

¹I do not consider countries which are small, both in terms of population (below one million inhabitants) and in terms of GDP (below one billion USD). The final sample covers 119 countries.

- Identify reversal episodes as subsequent country-year observations that show reductions in the financial surplus half a standard deviation below the mean change as calculated in the previous step. Classify the first and last country-year observation as the start and end of each episode.
- Filter to keep reversal episodes that contain at least one country-year observation with a reduction in the financial surplus one standard deviation below the mean change.
- Filter again to keep reversal episodes that are accompanied by a fall in GDP per capita during the same year or the year that follows immediately after. Surviving episodes are classified as sudden stops.

Note that one year episodes starting in 2009 are dropped from the final sample as they simply capture the global trade collapse that followed the burst of the 2008 financial crisis instead of a country-specific reversal of capital flows.

A.3 Robustness

This appendix reports robustness checks for the differential behavior of productivity across exchange rate regimes shown in the right panel of Figure I.

Alternative Exchange Rate Classification The classification of episodes by exchange rate regime is central to the exercise. In the baseline, I distinguish four regimes according to their degree of exchange rate flexibility—currency union, hard peg, soft peg and float—using the *de facto* classification of [Ilzetki, Reinhart and Rogoff \(2019\)](#). The first panel of Figure A.5 instead uses the classification of [Klein and Shambaugh \(2008\)](#), which allows for regime changes at higher frequency. Some episodes are consequently assigned to a different regime, but the productivity patterns remain similar to the baseline.

The baseline classification assigns each episode the exchange rate regime in place during the last year of the sudden stop. This reflects the fact that many countries abandoned pre-existing pegs in response to a sudden stop, which through the lens of the model amounts to allowing a nominal depreciation. In some cases, however, the collapse of a peg may itself have preceded the capital outflow. The second panel of Figure A.5 therefore classifies episodes according to the regime in place at the start of the sudden stop. The productivity response under floats is very similar to the baseline, while the response within currency unions is unchanged.

Detrending Window Length In the baseline, each series is detrended using a linear trend estimated over the five years preceding the sudden stop. A longer window may provide a better estimate of medium-run trends, but reduces the number of episodes for which sufficient pre-event

data are available. The third panel of Figure A.5 repeats the exercise using a ten-year pre–sudden-stop window. The decline in productivity under floats is somewhat smaller, but remains significant, while productivity within currency unions remains broadly stable.

Development Level Currency-union episodes are disproportionately concentrated among advanced economies, so the baseline comparison may partly reflect differences in the level of development. I therefore repeat the exercise separately for advanced and developing economies, using the IMF World Economic Outlook (April 2018) classification, with Haiti, Gabon, Rwanda, Sierra Leone, and Moldova assigned to the developing group. Given the smaller samples, I widen the regime bins: less flexible groups currency unions with hard pegs, while more flexible groups soft pegs with floats.

The fourth and fifth panels of Figure A.5 report the results. In both groups, productivity is more resilient under the less flexible regimes. The confidence bands widen and overlap in these smaller samples, but the ordering of the point estimates is the same as in the baseline.

Type of Crisis Finally, I examine whether the results depend on whether the sudden stop occurs during a global downturn. I classify an episode as *global* if world GDP growth is negative at any point from one year before to one year after the onset ($t = 0$), and as *regional or local* otherwise. I group regional and local episodes together because too few fixed-regime sudden stops occur outside a regional downturn to consider local crises separately. World GDP growth is taken from the IMF World Economic Outlook.

The last two panels of Figure A.5 report the results for global and regional/local sudden stops. As above, currency unions and hard pegs are grouped together, as are soft pegs and floats, to preserve statistical power. In both samples, productivity is more resilient under the less flexible exchange rate regimes, as in the baseline.

B Model Details

B.1 Propositions in Relative Prices

Since firms’ decisions depend only on relative prices, Propositions 1 and 2 can be stated without the nominal multiplier λ or wage W . As Melitz–Ottaviano preferences admit no consumption price index, I express nominal values in foreign currency: households save in foreign-currency bonds, so dividing the budget constraint (2) by e , the domestic-currency price of a unit of foreign currency, is the natural deflator. Writing the multiplier, the wage, and the fixed price κ of the second factor (footnote 19) in these units,

$$\hat{\lambda} \equiv e\lambda, \quad w \equiv \frac{W}{e}, \quad r \equiv \frac{\kappa}{e},$$

the Euler equation (7) and wage-setting condition (8) take the forms $\hat{\lambda} = \beta R \mathbb{E}[\hat{\lambda}']$ and $\hat{\lambda}w^* = \varepsilon_w / (\varepsilon_w - 1)$, so $\hat{\lambda}w = \lambda W$ is numeraire-invariant. Under the currency union $e = 1$ and the two representations coincide.

Proposition 4. *In the competitive equilibrium,*

$$d \ln z^H = \underbrace{s d \ln N}_{\text{pro-competitive}} + \underbrace{\sigma d \ln w + (1 - \sigma) d \ln r}_{\text{cost}} + \underbrace{d \ln \hat{\lambda}}_{\text{demand}}.$$

The cost channel is the change in real marginal cost, a share-weighted average of the two factor prices in foreign currency, and the demand channel is the marginal utility of foreign-currency wealth.

Proposition 5. *Given a sudden stop:*

1. *Under a float, $d \ln W = d \ln \lambda = 0$, so $d \ln w = d \ln r = -d \ln e$ and $d \ln \hat{\lambda} = d \ln e$. The cost and demand channels are both active but exactly offset, leaving $d \ln z^H = s d \ln N < 0$.*
2. *Under a currency union, $e = 1$; sticky wages move the wedge λW , the channels no longer offset, and all three stay active, so $d \ln z^H \geq 0$.*

The float's two silent channels in Proposition 2 are thus equal and opposite movements in the real wage and the marginal utility of wealth, driven by the same depreciation; the offset is specific to the float, where flexible wages hold the wedge fixed.

B.2 Robustness: Preferences and Imported Inputs

This appendix examines the robustness of Proposition 1 to two extensions of the baseline model: CES preferences and imported intermediate inputs. In both cases, the focus is on how these extensions modify the channels through which shocks affect the domestic productivity threshold.

CES preferences. Suppose household preferences feature a Dixit–Stiglitz aggregator over consumption varieties,

$$Q = \left[\int_{j \in \Omega} q_j^{\frac{\eta-1}{\eta}} dj \right]^{\frac{\eta}{\eta-1}}, \quad \eta > 1,$$

and utility is linear in the consumption aggregate, $U = Q - L$, as in the baseline, so that the marginal utility of Q is one and household optimality implies $\lambda P = 1$, where P is the CES price index. Firms face a fixed operating cost f in nominal terms. Profit maximization implies a constant markup over marginal cost,

$$p(z) = \frac{\eta}{\eta - 1} \frac{W^\sigma}{z}.$$

The productivity threshold is the zero-profit cutoff. Combining CES pricing, the household's price-index relation, and Pareto aggregation gives the threshold

$$z^H = \frac{\eta}{\eta-1} \left(\frac{k+1-\eta}{k} \right)^{\frac{1}{\eta-1}} \frac{\lambda W^\sigma}{N^{\frac{1}{\eta-1}}}, \quad (17)$$

where N denotes the number of active varieties and, provided $k > \eta - 1$ (so the relevant Pareto moment is finite), average revenue per firm is pinned down by parameters under CES preferences. The zero-profit condition $\pi(z^H) = 0$, with fixed cost f , closes the model by pinning the mass of active varieties N (equivalently, average revenue); because under CES–Pareto cutoff revenue is a fixed multiple of average revenue, f does not enter the cutoff expression (17).

Log-differentiating (17) delivers the following result.

Proposition 6. *In the stationary equilibrium with CES preferences,*

$$d \ln z^H = \underbrace{-\frac{1}{\eta-1} d \ln N}_{\text{Varieties}} + \underbrace{\sigma d \ln W}_{\text{Cost}} + \underbrace{d \ln \lambda}_{\text{Demand}}.$$

Relative to the baseline model, all three channels remain operative. A key difference is that an increase in the number of varieties lowers the productivity threshold. This reflects the homotheticity of CES preferences, which keeps relative revenue shares constant and implies that expanding the mass of firms raises total revenue without tightening competition at the firm level.

Imported intermediate inputs. Next, suppose firms produce using labor and intermediate inputs, $q(z) = z l(z)^\sigma x(z)^{1-\sigma}$, where intermediates are assembled from domestic and foreign varieties,

$$x(z) = \left[(x^H(z))^{\frac{\chi-1}{\chi}} + (Y x^F(z))^{\frac{\chi-1}{\chi}} \right]^{\frac{\chi}{\chi-1}}.$$

Intermediate inputs are supplied competitively and separately from the differentiated consumption varieties: the domestic input is produced with one unit of labor per unit and is priced at W , and the foreign input is available at the foreign price, normalized to one, so that its price in domestic currency is e . The effective price of intermediates is

$$p^I = W \left[1 + \Theta^{\chi-1} \right]^{\frac{1}{1-\chi}}, \quad \Theta \equiv \frac{Y W}{e},$$

Cobb–Douglas cost minimization then gives the unit cost

$$mc(z) = \frac{1}{z} \left(\frac{W}{\sigma} \right)^\sigma \left(\frac{p^I}{1-\sigma} \right)^{1-\sigma} \propto \frac{W}{z} \left[1 + \Theta^{\chi-1} \right]^{\frac{1-\sigma}{1-\chi}},$$

so unit production costs depend on both wages and the price-adjusted quality advantage of foreign inputs.

The zero-profit condition for the marginal firm implies the threshold

$$z^H = \frac{\lambda W [1 + \Theta^{\chi-1}]^{\frac{1-\sigma}{1-\chi}}}{\alpha \gamma} \left[\gamma + \frac{\eta}{2k+2} N \right]. \quad (18)$$

Log-differentiating (18) yields the following decomposition.

Proposition 7. *In the stationary equilibrium with imported intermediate inputs,*

$$d \ln z^H = \underbrace{s d \ln N}_{\text{Varieties}} + \underbrace{d \ln W}_{\text{Cost}} + \underbrace{\zeta d \ln \Theta}_{\text{Foreign Quality}} + \underbrace{d \ln \lambda}_{\text{Demand}},$$

where $s \in (0, 1)$ is the pro-competitive elasticity of Proposition 1 and $\zeta \equiv -(1 - \sigma) \frac{\Theta^{\chi-1}}{1 + \Theta^{\chi-1}} \in (-(1 - \sigma), 0)$.

The foreign quality channel operates as the inverse of a foreign cost channel: an increase in Θ lowers effective production costs and relaxes the productivity threshold. Since Θ decreases during a sudden stop under both exchange rate regimes, this channel tightens the threshold in both cases. Under the pure float, with $d \ln W = d \ln \lambda = 0$, the cutoff responds as $d \ln z^H = s d \ln N + h d \ln e$, where $h \equiv -\zeta > 0$: the pro-competitive channel lowers the threshold while the foreign-quality channel raises it. Using the relation for the mass of varieties, the cutoff falls only if $h < k\omega / (1 + k\omega)$, where ω is the imported-variety share, so the unambiguous decline of Proposition 2 extends to imported inputs only when their cost elasticity is small relative to this bound. While conceptually interesting, it is not incorporated into the quantitative model, as imported intermediates are used by a subset of firms and appear empirically less relevant for exit dynamics.

C Firm-level Data

C.1 Evolution of Aggregate Productivity in Spain

This appendix provides background and clarification on the evolution of aggregate productivity in Spain during the period considered in the paper. It addresses concerns regarding the choice of data sources, pre-sudden stop trends, and the comparison with manufacturing TFP.

Alternative data sources Panel A of Figure A.6 shows that all five leading aggregate TFP data sources point to an increase in TFP relative to trend during 2010–13, despite differing views on the behavior of TFP in levels. While AMECO and, to a lesser extent, the OECD suggest a stabilization

or mild increase in aggregate TFP over this period, other sources—such as EU KLEMS, the Conference Board, and the Penn World Tables—continue to show declining levels, albeit at a slower pace. Crucially, once TFP is evaluated relative to its pre-crisis trend, the implied deviation during the sudden stop is positive across all sources.

Discrepancies in levels reflect differences in underlying data and methodological choices. AMECO and OECD rely on standard growth-accounting measures of TFP constructed as Solow residuals from real GDP and factor input shares. EU KLEMS incorporates more granular adjustments for factor composition and utilization. The Conference Board and Penn World Tables adopt alternative aggregation and comparison methods, including two-period averaging and international Törnqvist index constructions. Given its transparency, standardization, and policy relevance in the European context, AMECO serves as the benchmark series in the main text.

Pre-sudden stop trend in productivity Throughout the paper, aggregate variables are analyzed relative to their pre-crisis long-term trends. This follows the established convention in the sudden stop literature, where the focus is on how financial crises disrupt existing trajectories rather than on levels.

In the case of the 2010–13 episode, aggregate productivity was already on a declining path. For the 1992–93 episode, although official statistics are only available from 1995 onward, historical evidence suggests a similar pattern: [Prados De la Escosura \(2017\)](#) documents a stalling of productivity growth as early as the mid-1980s. If productivity was falling prior to both episodes, the relevant contrast lies in how TFP behaved relative to trend when each sudden stop hit.

Total economy vs. manufacturing TFP The baseline series used in the introduction refers to the total economy. However, the rest of the paper, particularly the firm-level analysis, focuses on manufacturing firms. Panel B of Figure A.6 compares the evolution of Spanish TFP in the total economy with that in the manufacturing sector over the years for which data are available and confirms that the trends are broadly similar.

C.2 Data Cleaning, Definition of Variables and Deflating Nominal Measures

This appendix describes the data cleaning procedure, the definition of specific variables in the final dataset and the use of price deflators. Regarding the former, I restrict each firm’s history to the span between its first and last year with complete information and strictly positive value added and capital stock. Years outside that span are dropped, while years inside it with missing, negative or zero values are treated as temporary interruptions rather than as exit, and a firm whose final years report non-positive values is dated as exiting in its last complete year. This prevents firms from disappearing (and maybe then reappearing) in the sample strictly due to the cleaning procedure, which is vital to correctly capture entry and exit to the market. The restriction affects

few observations: 144 firm-years (0.3%) report negative value added and 27 report zero capital. The efforts devoted to ensure consistency and accuracy during the ESEE data collection process minimize the loss of observations resulting from this requirement.

Regarding the latter, I measure real output as nominal value added divided by an output price deflator. Obtaining an appropriate industry-specific output price deflator series is challenging for two reasons. First, the data needs to go back in time at least until 1990, while Eurostat series, the standard source, only start around 2000. Instead, I use the producer price index provided by the Spanish National Statistics Institute (NSI) at the three-digit industry level. Second, the ESEE provides its own industry classification that maps NACE Rev.2 codes to 20 manufacturing industries. Given that the mapping is not strictly one-to-one, deriving corresponding industry-specific deflators requires implementing a weighting strategy.² My approach is to use sector contribution to total manufacturing value added in 2018, also provided by the NSI, as the relevant weight.³

I follow the literature in using the wage bill, deflated by the above price series, instead of employment to measure the labor input, in order to control for heterogeneity in labor quality across firms. To measure capital stock I use two different variables given existing data restrictions: for the 1990-1999 period I use total real net capital stock whereas for the 2000-2014 period I use the book value of fixed assets deflated by the price of investment goods from the Spanish National Statistics Institute.^{4,5}

Using these variables, I estimate industry output elasticities for capital and labor using [Akerberg, Caves and Frazer \(2015\)](#)'s algorithm and compute firm-level productivity as a Solow residual.

C.3 Sample Representativeness and Firm Composition

Representativeness A well-known shortcoming of the ESEE dataset is its over-representation of large firms. To address this issue, I exploit dynamic sampling weights constructed by the SEPI Foundation based on Census data. Figure A.9 shows that the weighted sample closely matches the actual firm size distribution as documented by Eurostat, substantially improving upon the raw (unweighted) data. In addition, Table A.4 validates the weighted sample along the extensive margin by comparing entry and exit rates for firms with ten or more employees to the Spanish

²For example, manufacturing industry with ESEE code 7 (paper) corresponds to NACE Rev.2 codes 171 and 172.

³The NSI provides weightings for the 2010-2018 period only. I use 2018 figures, as opposed to taking an average or an alternative year, because 2018 is the only year for which there are no missing values.

⁴Total real net capital stock is defined as the value of the stock of total net capital at 1990 constant prices which I simply convert into base year (2015) prices.

⁵I conduct several robustness exercises in order to check whether the change in the capital stock measure has an impact on the results. First, for the years for which the two series overlap, 1993-1999, I estimate that the correlation coefficient at the firm-level is 0.9. Second, for the 1993-1999 period, I estimate the production function using the two series separately and then compare resulting coefficients - for 18 out of 20 industries the differences in the estimated elasticities are below 0.1 in absolute value. Finally, I redo the analysis splitting the sample before and after 1999 such that the two series do not interact in any way during the production function estimation stage, with the same qualitative results for the decomposition and the exit regressions.

Business Registry (*Directorio Central de Empresas*, DIRCE), both over time and across three-digit manufacturing sectors.

One remaining challenge of the ESEE dataset is that it provides limited information on micro firms, i.e., firms with nine employees or less.⁶ According to administrative data, over 80% of all firms in the Spanish manufacturing sector are micro firms; yet, they account for only 9% of production and 11% of the wage bill.⁷ Given the latter, the empirical disregard for micro firms is generally not a concern in macroeconomic analyses that emphasize the intensive margin. However, this paper also examines the role of the extensive margin, making it important to understand the potential bias introduced by firm-size truncation.

Figure A.10 shows that the share of micro firms in the Spanish economy has followed a remarkably stable pattern, particularly in the 15 years preceding the 2010–13 sudden stop. While official data is unavailable before 1995, this alleviates concerns that the bias introduced by truncation differs substantially across sudden stops. As an additional check, Online Appendix C.7 uses ORBIS data, which provide substantially better coverage of micro firms and small and medium-sized manufacturing firms. Its shorter time coverage restricts the Spanish analysis to the 2010–13 sudden stop, so I complement it with the 2011–13 sudden stop in the Czech Republic, which occurred under a relatively flexible exchange rate arrangement.

Firm Composition across Episodes Table A.5 compares firms exposed to the two sudden stops along observable characteristics, including age, size, productivity growth, capital intensity, leverage, and trade engagement. The main differences are in age and openness to trade: firms in the later episode are older and more frequently engaged in international trade. Given the 18-year gap between episodes, these differences are not surprising. The bottom section of Table A.5 also shows some differences in industry composition. While the shifts are minor in magnitude, they are statistically significant for nearly half of the sectors. The firm-level specifications in the main text therefore control for firm size and age and include industry-year fixed effects.

C.4 Revenue versus Physical Productivity

Because firm output is obtained by deflating value added with three-digit industry price indices, the Solow residual estimated in Section 5.1 measures revenue productivity (TFPR) rather than physical productivity (TFPQ, which I denote z). A concern is that cross-firm variation in markups within an industry is then misattributed to productivity. I use the model of Section 3 to relate the two measures and to assess how the distinction affects each empirical exercise.

In the model labor is the only input and there are no intermediates, so value added equals sales and the wage bill is proportional to employment; the derivation below therefore applies to

⁶Micro firms are present only if they entered the sample with at least ten employees and later shrank below the threshold.

⁷Data corresponds to the Structural Business Statistics for years 2005–2020 as reported by Eurostat.

the deflated value added and wage-bill measure used in the data. Consider a domestic producer with marginal cost $mc(z) = W^\sigma/z$. Its optimal price and gross markup are

$$p^H(z) = \frac{1}{2} \left(p^{max} + \frac{W^\sigma}{z} \right), \quad \mu(z) \equiv \frac{p^H(z)}{mc(z)} = \frac{1}{2} \left(\frac{p^{max}}{W^\sigma} z + 1 \right) = \frac{1}{2} \left(\frac{z}{z^H} + 1 \right), \quad z^H \equiv \frac{W^\sigma}{p^{max}},$$

where z^H is the productivity cutoff for domestic production, so that firms operate only for $z > z^H$. Deflating sales $p^H(z) q^H(z)$ by a common deflator $\bar{P}$ yields

$$\ln \text{TFPR}(z) = \ln z + [\ln p^H(z) - \ln \bar{P}] = \ln \mu(z) + \sigma \ln W - \ln \bar{P},$$

so, up to an industry-year constant, measured productivity coincides with the firm's markup. The markup is strictly increasing in productivity, $\mu'(z) = p^{max}/(2W^\sigma) > 0$, so TFPR is a strictly monotone transformation of TFPQ and ranks firms identically. The mapping is not affine in $\ln z$: the elasticity $\partial \ln \text{TFPR} / \partial \ln z = z/(z + z^H)$ rises from one-half at the cutoff to one for the most productive firms, so it preserves the ordering of firms while compressing the distances between them, most strongly near the cutoff.

This monotonicity is enough for the results that depend on firms' rankings or percentiles; the exercises that depend on cardinal productivity differences require more care.

First, the cleansing regressions (Table III) enter productivity as a continuous regressor, which the model identifies with $\ln(z + z^H)$ up to an industry-year constant. This is monotone, so the sign of selection is unaffected, but it is nonlinear and z^H varies over time, so the interactions with the sudden-stop dummies could in principle be distorted. Since the two measures rank firms identically, I re-estimate the specifications using each firm's within-industry-year productivity percentile, r_{it} , which is invariant to the TFPR/TFPQ distinction. Table A.10 reports the results: selection strengthens in 2010–13 and is absent in 1992–93 along both the exit and labor growth margins, and these interactions remain stable across the additional controls, as in the baseline.

Second, the decomposition (Table II) is the exercise most sensitive to the distinction, since all of its terms depend on cardinal productivity differences. The entry and exit terms compare firms within a given year, so the markup compresses the relevant gaps and these contributions understate the underlying reallocation; the within-firm term is harder to sign, as it also reflects movements in the cutoff z^H over the episode. Because the components can move in different directions, I assess the net effect directly with the quantitative model: Table A.11 repeats the decomposition on simulated data, once using physical productivity z and once using model-implied revenue productivity $\text{TFPR}(z)$.

C.5 The Lower Tail of the Productivity Distribution

I first document changes in the distribution of firm-level productivity before and after each of the crises. A visual inspection of the kernel probability distribution estimate of log TFP before and after each of the two sudden stops confirms there is ample heterogeneity in TFP levels among firms in any given year as already highlighted by the literature. The central part of the distribution remains broadly similar, while the lower tail exhibits particularly pronounced changes.

To see this graphically, Figure A.11 presents the percentage change in average productivity for each percentile of the productivity distribution during the two sudden stops. On average, the difference in the change in productivity across episodes, the gap between the red and blue lines, is roughly constant across the entire distribution, with the notable exception of the 5th percentile where TFP decreases by 41% during 1991–1993 while increases by 8% during 2009–2013. Although the error bands are admittedly wide in both cases, the difference relative to other percentiles is large enough to remain relevant—the gap is three times the average.

Estimated moments of the distribution support the predominant role of the lower tail with higher-order moments experiencing the largest swings.⁸ During the 1992–93 crisis firms display lower productivity on average and the dispersion of log TFP increases. The increase in dispersion, however, is asymmetric. The distribution of unproductive firms expands while that of productive firms changes little with the coefficient of skewness declining from -0.40 to -1.04. Moreover, increasing kurtosis, 6.12 versus 9.14, is associated with fatter tails as the probability mass moves away from the shoulders of the distribution. Although the behavior of TFP exactly reverses during the 2010–13 crisis—productivity increases while dispersion drops—it is still the tails, and especially, the lower tail, that changes the most. In this case, skewness increases from -2.21 to -0.65 while kurtosis shrinks from 24.98 to 6.40.

C.6 TFP Growth Decomposition

This appendix derives the TFP growth decomposition specification used in Table II. Define aggregate productivity, Z_t , as a weighted average of firm-level TFP. Given that the focus is on firm dynamics, I express overall aggregate productivity as the weighted sum of the aggregate productivities of incumbents, Z_t^C , entrants, Z_t^N , and exiters, Z_t^X ,

$$Z_t \equiv \sum_{i \in N_t} s_{i,t} Z_{i,t} = s_t^C Z_t^C + s_t^N Z_t^N + s_t^X Z_t^X,$$

where $s_{i,t}$ is the employment share of firm i and N_t the total number of firms in the economy, both at time t . In addition, s_t^j is the total employment share and $Z_t^j \equiv \sum_{i \in j} s_{i,t}^j Z_{i,t}^j$ is the aggregate productivity of firms pertaining to group j , where $s_{i,t}^j = s_{i,t} / s_t^j$ and $j = \{C, N, X\}$.

⁸Refer to Table A.6 for further details.

The variable of interest is the change in aggregate productivity from period $t - 1$ to period t , ΔZ_t . It follows that the relevant groups for the analysis are: incumbents in both periods, firms exiting at period $t - 1$ and firms entering in period t . This implies that $s_{t-1}^N = s_t^X = 0$. By exploiting the fact that $s_{t-1}^C + s_{t-1}^X = 1$ and $s_t^C + s_t^N = 1$ and using the expression above, I can rewrite the change in aggregate productivity as

$$\Delta Z_t = Z_t^C - Z_{t-1}^C + s_t^N (Z_t^N - Z_t^C) - s_{t-1}^X (Z_{t-1}^X - Z_{t-1}^C) .$$

The interpretation of the above decomposition partly coincides with that of [Melitz and Polanec \(2015\)](#): entrants (exiters) contribute positively to TFP growth when their average productivity is higher (lower) than the incumbents' counterpart. These contributions are weighted by the employment share of entrants, s_t^N , and exiters, s_{t-1}^X , respectively.⁹ I abstract, however, from decomposing the contribution of incumbents further using [Olley and Pakes \(1996\)](#)'s approach.¹⁰ Instead, I follow [Dias and Marques \(2021\)](#) in tracking individual incumbent firms over time so that I can distinguish between the contributions of firm-level productivity growth and employment share reallocation among them.

Given the definition of Z_t^C , the change in aggregate productivity can be further decomposed as:

$$\Delta Z_t = \sum_{i \in C} s_{i,t-1}^C \Delta Z_{i,t} + \sum_{i \in C} Z_{i,t-1} \Delta s_{i,t}^C + \sum_{i \in C} \Delta s_{i,t}^C \Delta Z_{i,t} + s_t^N (Z_t^N - Z_t^C) - s_{t-1}^X (Z_{t-1}^X - Z_{t-1}^C) .$$

The contribution by incumbents maps exactly into that in [Foster, Haltiwanger and Krizan \(2001\)](#). The first term measures the contribution of within-firm productivity changes of incumbents weighted by their initial share. The second term captures the contribution of market share reallocation. The third term is known as the cross-effect, it is the covariance of market share and productivity changes for the individual firm.

⁹This version differs from the widely used [Foster, Haltiwanger and Krizan \(2001\)](#) decomposition in allowing for differences in the reference productivity for entrants, exiters and incumbents. Intuitively, the contribution of entrants (exiters) is the composition effect of adding the new firms to (removing the firms that will exit from) the aggregate, relative to the productivity of continuing firms. Moreover, it has a direct mapping into a theoretical model of firm productivity heterogeneity, circumventing the recent criticism to accounting exercises measuring reallocation posed by [Hsieh and Klenow \(2017\)](#).

¹⁰[Olley and Pakes \(1996\)](#) would simply set:

$$Z_t^C - Z_{t-1}^C = \Delta \bar{Z}_t^C + \Delta Cov(s_{i,t}^C, Z_{i,t}^C) .$$

C.7 Robustness

C.7.1 Differences in Crisis Duration

As already mentioned, a notable difference across the two sudden stops discussed is the length of each of these crises. This could be particularly problematic in a world in which firms postponed their decision to shut down, incurring negative profits, until they are unable to roll on credit any further. Under this assumption, it can be argued that the observed larger contribution of exit during the 2010-13 episode is a mechanical effect of its duration. In other words, if the 1992-93 crisis had been longer, more unproductive firms would have exited the market.

To address this concern directly, this appendix compares the decomposition of productivity growth during the first sudden stop with an analogous decomposition for the second sudden stop—that is, a window of equal length to the earlier crisis. Table A.7 reports the contribution of incumbents, entrants, and exiters to aggregate productivity growth over these matched horizons (1992-93 versus 2010-11).

The results indicate that aligning the length of the two episodes does not alter the central conclusions. In both crises, productivity at the firm level is procyclical, generating a negative within-firm contribution. In the earlier episode this within-firm decline dominates, whereas in the later episode it is neutralized by positive reallocation forces, i.e., the between-firm and cross-terms. As a result, the cumulative increase in aggregate TFP over 2010–11 is slightly larger than when considering the full window.

The main qualitative difference across episodes—the strength of the composition effect—remains. Although the contribution of exiters is somewhat smaller over 2010–11 than in the full episode, it is still almost twice the size of the exit contribution during 1992–93. Moreover, in the shorter window, the net entry contribution remains positive and continues to be the main driver of aggregate productivity growth overall. Hence, the stronger role of exit in the later sudden stop cannot be fully attributed to its longer duration.

C.7.2 TFP Growth Decomposition

Alternative Decompositions There are two types of productivity decomposition exercises performed by the existing literature. The first involves following firms over time, tracking their changes to both shares and productivity: [Baily et al. \(1992\)](#), [Griliches and Regev \(1995\)](#), [Foster, Haltiwanger and Krizan \(2001\)](#). Alternatively, [Olley and Pakes \(1996\)](#) propose a decomposition based on moments of the joint distribution of market shares and productivity, which [Melitz and Polanec \(2015\)](#) extend to accommodate entry and exit. As explained above, I choose to combine [Foster, Haltiwanger and Krizan \(2001\)](#) and [Melitz and Polanec \(2015\)](#) to capture the best of both approaches.

Table A.8 shows that the key take-aways are robust to either type of original decompositions.

Columns (4) and (5) correspond to the [Foster, Haltiwanger and Krizan \(2001\)](#) decomposition: the increase in TFP in the 2010-13 sudden stop is driven by substantial exit of unproductive firms and reallocation of shares towards more productive incumbents. This cleansing mechanism fully offsets the decline in firm-level productivity as in the baseline decomposition. Columns (6) and (7) correspond to the [Melitz and Polanec \(2015\)](#) decomposition, which only differs from the baseline on the break-down of the incumbents' contribution. In both episodes we observe a sizable leftward shift in the productivity distribution of incumbents, and the market share covariance, in line with cleansing, is positive in both but much larger in the latter (4.41 against 0.66 percentage points), cushioning the negative contribution of incumbents to overall productivity growth.

Alternative Weights Table A.9 presents the results for the TFP growth decomposition exercise in the main text, but aggregating TFP using alternative weights: value-added and sales. It is still the case, that the fall in TFP during the 1992-93 episode is driven mainly by the behavior of incumbents and, more specifically, by the decline in within-firm productivity. The contribution of net entrants, in particular the exit of unproductive firms, is still the main driver of productivity growth during 2010-13. The only difference is the negative between-firm contribution. However, it is compensated by a large positive covariance between productivity and market share changes at the firm level such that the overall negative contribution of incumbents during the latter period is dampened (and, with value-added weights, turns slightly positive). All in all, key results hold when aggregating TFP using value-added or sales.

C.7.3 Comparability of Episodes

This appendix discusses differences between the 1992–93 and 2010–13 episodes that could potentially affect their comparability.

Structural and institutional change. The 18-year interval between the two episodes brought substantial changes in the Spanish economy, including a decline in the importance of manufacturing, labor-market reforms, deeper European integration, and the expansion of global value chains. I assess to what extent these changes can account for stronger selection at exit in 2010–13 in several ways.

Manufacturing's share of GDP fell from around 20% in the early 1990s to roughly 12% by 2009. Since the firm-level analysis is restricted to manufacturing, this decline does not directly affect the sample. If anything, the smaller aggregate importance of manufacturing should weaken the feedback from manufacturing shocks to aggregate demand in the later episode, working against the stronger exit response I document. Moreover, Table A.2 shows moderate shifts in the composition of manufacturing across two-digit sectors between 1993 and 2007, concentrated in food, metal-

lurgy and textiles.¹¹ The regressions also include industry-by-year fixed effects, which absorb time-varying shocks common to firms within the same industry.

Table A.15 goes further by controlling for firm characteristics that proxy for differential exposure to structural change. I add the share of temporary workers, the share of workers without a degree, and exports and imports as shares of sales, capturing respectively exposure to labor-market reforms affecting the temporary–permanent employment margin, changes in skill composition and offshoring, and the depth of firms’ integration into international markets and production networks. Including these controls individually or jointly leaves the estimated interaction between productivity and the 2010–13 sudden stop essentially unchanged: it ranges from -0.050 to -0.052 , while the corresponding interaction for 1992–93 remains small and statistically insignificant.

Table A.16 provides a complementary timing test. If the structural and institutional changes separating the two episodes were themselves responsible for stronger selection, the exit–productivity coefficient should already have changed during tranquil periods before the 2010–13 sudden stop. Instead, it is very similar in the tranquil peseta years 1994–98 and the tranquil euro years 1999–2007 (-0.032 versus -0.038 ; $p = 0.74$). The coefficient is more negative during the deep recession of 2008–09 (-0.054), though not significantly different from 1999–2007 ($p = 0.36$). During the 2010–13 sudden stop it reaches -0.090 , about 1.7 times its 2008–09 value (a difference with $p = 0.08$) and significantly below both the 1999–2007 coefficient and that observed during the 1992–93 sudden stop.¹² The test cannot speak to changes that coincided with the episode itself.

The construction boom and bust. The burst of the 2000s property bubble in 2008 provides a natural alternative explanation for the sharp rise in firm exit during the 2010–13 crisis. The ESEE dataset excludes the construction sector, so the firm-level sample is not directly affected by the collapse in construction activity. Manufacturing firms could nevertheless have been exposed indirectly through input–output linkages or local demand conditions. Industry-by-year fixed effects absorb the former to the extent that exposure is common within manufacturing industries. Since the construction boom and bust was also highly uneven across Spanish regions, column (6) of Table A.15 additionally includes region-by-year fixed effects, allowing for arbitrary time-varying shocks common to firms in the same *comunidad autonoma*. The estimated 2010–13 productivity interaction remains essentially unchanged, moving from -0.050 to -0.051 .

Union-wide policies and TARGET2. A further concern is that European policymakers responded to the 2010–13 sudden stop with a range of union-wide policies that were not available during the 1992–93 episode. In particular, the Eurosystem’s liquidity provision, reflected in the buildup

¹¹Unfortunately, 1993 is the earliest year for which disaggregated data are available, and the aggregation is at the two-digit level, whereas the firm-level analysis is conducted at the three-digit level.

¹²The years 2003–04 are excluded because an ESEE sample refresh generates a mechanical spike in recorded exits in 2003 followed by an offsetting trough in 2004. Including them leaves the results essentially unchanged; in particular, the placebo p -value becomes 0.59.

of TARGET2 imbalances, provided an important cushioning mechanism. Through the Eurosystem, national central banks could extend credit that replaced reduced private inflows with public funds, thereby cushioning the deleveraging shock during the 2010–13 crisis. The availability of these tools reflects the institutional framework of a currency union and distinguishes it from a standard fixed exchange rate regime.¹³ For the purposes of this paper, what matters most is that, if such policies indeed mitigated the shock in 2010–13, the observed patterns should be interpreted as a *lower bound* on the selection at exit induced by a sudden stop under a currency union.

Net foreign asset position. Spain entered the 2010–13 episode with a notably weaker external balance sheet than in the early 1990s: its net international investment position was roughly –20% of GDP in the mid-1990s, compared with close to –90% of GDP on the eve of the second sudden stop according to Eurostat. This more negative external position implies greater exposure to foreign shocks and could, in principle, intensify the contractionary effects of a sudden stop in 2010–13. However, this type of vulnerability should operate primarily through firms’ balance sheets—via tighter credit conditions, greater reliance on external funding, or higher leverage—and should therefore be at least partly captured by the leverage and borrowing-cost controls in Table III.

A related concern is that the composition of external liabilities also changed over time. Data from the Bank of Spain indicates that inward FDI liabilities rose from roughly 15–20% of GDP in the mid-1990s to 41.6% of GDP in 2008. Crucially, however, this expansion occurred primarily in finance, real estate, energy, and telecommunications, rather than in manufacturing. Sectoral FDI statistics confirm that the manufacturing share of inward FDI remained modest and broadly stable over this period. The ESEE data reflect the same pattern: foreign ownership within Spanish manufacturing is limited, stable, and shows no meaningful shift across the two episodes. Moreover, multinational affiliates generally rely on internal capital markets and tend to exhibit lower exit rates during credit tightening. Taken together, these facts suggest that shifts in external liability composition are unlikely to be a main driver of the episode-specific differences in exit.

C.7.4 An Alternative Case Study Using Orbis

The ORBIS global company database, compiled by Bureau van Dijk, has become the leading source for firm-level analysis due to its extensive coverage. Crucially for this analysis, ORBIS collects information on micro-firms (those with fewer than 10 employees) and significantly enhances the coverage of small and medium-sized enterprises (SMEs) within the Spanish manufacturing sector. However, its time coverage begins only in the late 1990s, restricting its use to the 2010–2013 sudden stop, for which I can rerun the analysis using this alternative dataset.

¹³However, the model in Section 3 does not capture these institutional differences and treats fixed exchange rate regimes and currency unions equivalently.

My strategy is to identify a different sudden stop suitable for a case study under a relatively flexible exchange rate arrangement. To do so, I search among the episodes detected by the algorithm in Section 2 (see Table A.1) for those that (i) occurred outside a currency union and (ii) exhibit adequate manufacturing sector coverage in ORBIS, as documented by [Kalemli-Özcan et al. \(2024\)](#). The Czech Republic’s sudden stop during 2011–2013 emerges as an ideal candidate. Beyond the availability of comparable micro data, this episode unfolded in a similarly advanced economy and within a comparable time frame. As in the case of Spain’s 1992–1993 sudden stop, aggregate TFP declined markedly, by roughly 4% according to the aggregate sources used in Section 2.

In ORBIS, a firm is classified as having exited if its last record reports a legal status of bankruptcy, dissolution (including following bankruptcy, demerger or liquidation) or liquidation. Firms that leave the database without such a status, or that are dissolved through a merger or takeover, are not counted as exits.

Tables A.12 and A.13 confirm the presence of a cleansing effect during Spain’s 2010–2013 sudden stop, which is notably absent during the Czech Republic’s 2011–2013 episode. Aggregating firm-level productivity within ORBIS, TFP increases by nearly 9% in Spain but falls by 7% in the Czech Republic. In both cases, the decomposition of TFP changes reveals two common features: (i) a negative within-firm productivity component and (ii) a significant role for net entry. In Spain, the exit of unproductive firms accounts for three-quarters of total TFP growth, while entrants contribute negatively, though only marginally. In contrast, the Czech episode is characterized by both entry and exit exerting negative effects on aggregate TFP, with the negative contribution from entrants playing a more prominent role.

The regression results echo these patterns. The Spanish sudden stop is marked by a strengthening of selection: the negative correlation between firms’ propensity to exit and their productivity intensifies. In the Czech Republic, however, selection weakens during the sudden stop—firm exits become less closely related to productivity. While ORBIS lacks information on firms’ participation in international trade—preventing me from testing several alternative channels discussed in the main text—Table A.14 shows that controlling for firms’ financial health leaves the sign and significance of the key productivity coefficients unchanged; the Spanish sudden-stop interaction is, if anything, larger in magnitude, although the sample with available leverage data is also smaller.

Despite focusing on a different episode and dataset, this new case study confirms the key asymmetry in firm behavior highlighted in the baseline analysis. Firm dynamics during sudden stops differ systematically depending on the exchange rate regime: selection operates more strongly under a currency union than under a flexible exchange rate regime.

D Quantitative Details

D.1 Computation of the Steady State

This appendix outlines the computation of the model without aggregate shocks. I omit the notation on Z_t as it is constant and equal to one here.

1. Set discrete grids on z^T . Set the Markov transition matrix for z^T . Set the distribution of the exit value x .
2. Guess for p^{max} .
3. For a given p^{max} , guess for W . Solve for $\lambda = \frac{\varepsilon_w}{\varepsilon_w - 1} \frac{1}{W}$ as well as $p^k(\tilde{\mu}, z^P, z^{T'})$, $q^k(\tilde{\mu}, z^P, z^{T'})$ and $\pi^k(\tilde{\mu}, z^P, z^{T'})$, for $k = \{H, X, M\}$ and $z^P = \{z^L, z^H\}$, where $z^{T'}$ is the realization of transitory productivity in the current period and $\tilde{\mu} = \{W, p^{max}\}$.
4. Optimization loop. Objects: $V(\tilde{\mu}, z^P, z^T)$, $V^c(\tilde{\mu}, z^P, z^{T'})$, and $\chi(\tilde{\mu}, z^P, z^T)$. For each $z^P = \{z^L, z^H\}$:

(a) Start with an initial value for $V(\tilde{\mu}, z^P, z^T)$. This is the beginning-of-period value for an incumbent.

(b) Calculate $V^c(\tilde{\mu}, z^P, z^{T'})$ by

$$V^c(\tilde{\mu}, z^P, z^{T'}) = \begin{cases} \pi(\tilde{\mu}, z^P, z^{T'}) + \beta V(\tilde{\mu}, z^P, z^{T'}) & \text{if } \pi(\tilde{\mu}, z^P, z^{T'}) > 0 \\ 0 & \text{otherwise} \end{cases}$$

(c) Calculate $V(\tilde{\mu}, z^P, z^T)$ by

$$V(\tilde{\mu}, z^P, z^T) = \int \max \left\{ E_z \left[V^c(\tilde{\mu}, z^P, z^{T'}) \middle| z^T \right], x \right\} d\xi(x),$$

where

$$E_z \left[V^c(\tilde{\mu}, z^P, z^{T'}) \middle| z^T \right] = \int V^c(\tilde{\mu}, z^P, z^{T'}) dH(z^{T'} | z^T).$$

Thus, the ratio of firms that exit with the state z is

$$\chi(\tilde{\mu}, z^P, z^T) = \int_{E_z[V^c(\tilde{\mu}, z^P, z^{T'}) | z^T]}^{\infty} d\xi(x).$$

(d) Update and repeat.

5. For each $z^P = \{z^L, z^H\}$, I can now calculate

$$V^e(\tilde{\mu}, z^P, s) = \int V^c(\tilde{\mu}, z^P, z^{T'}) dH^s(z^{T'} | s),$$

for each s and solve for the cutoff $s^*(z^P)$ by setting $V^e(\tilde{\mu}, z^P, s^*(z^P)) = c_e$.

The measure of entrants for unit M^s is given by:

$$g(\tilde{\mu}, z^P, z^{T'}) = \int_{s^*(z^P)}^{\infty} \mathbf{1}\{\pi(\tilde{\mu}, z^P, z^{T'}) > 0\} H^s(z^{T'}|s) dS(s).$$

6. Next, find

$$V^p(\tilde{\mu}) = \int \int \max \left\{ V^e(\tilde{\mu}, z^P, s) - c_e, 0 \right\} dS(s) dF(z^P).$$

Check if free-entry condition is satisfied: $V^p(\tilde{\mu}) = c_s$. If not, revise the guess for W in the third step. Repeat until convergence.

7. Calculate the stationary measure of operating domestic firms (last period's survivors, including inactive incumbents, plus current period's entrants), after receiving idiosyncratic shock, $\gamma(\tilde{\mu}, z^P, z^{T'})$, given $M^s = 1$:

$$\gamma(\tilde{\mu}, z^P, z^{T'}) = \int H(z^{T'}|z^T) (1 - \chi(\tilde{\mu}, z^P, z^T)) \gamma(\tilde{\mu}, z^P, z^T) dz^T + g(\tilde{\mu}, z^P, z^{T'}).$$

From linear homogeneity, the actual measure of operating firms will be $M^s \gamma(\tilde{\mu}, z^P, z^{T'})$.

8. Obtain M^s by exploiting goods market clearing. In particular

$$M^s = \frac{\int p^M(\tilde{\mu}, z) q^M(\tilde{\mu}, z) d\Gamma^*(z)}{\int e p^X(\tilde{\mu}, z) q^X(\tilde{\mu}, z) \gamma(\tilde{\mu}, z) dz}.$$

9. Finally, calculate the implied $p_{implied}^{max}$ as

$$p_{implied}^{max} = \frac{\frac{\alpha\gamma}{\lambda} + \eta P}{\gamma + \eta N},$$

where

$$P = M^s \int p^H(\tilde{\mu}, z) \mathbf{1}\{\pi^H(\tilde{\mu}, z) > 0\} \gamma(\tilde{\mu}, z) dz + \int p^M(\tilde{\mu}, z) \mathbf{1}\{\pi^M(\tilde{\mu}, z) > 0\} d\Gamma^*(z),$$

and

$$N = M^s \int \mathbf{1}\{\pi^H(\tilde{\mu}, z) > 0\} \gamma(\tilde{\mu}, z) dz + \int \mathbf{1}\{\pi^M(\tilde{\mu}, z) > 0\} d\Gamma^*(z).$$

10. Compare $p_{implied}^{max}$ with the guess in the second step, p^{max} . If they are not close enough, revise the guess and repeat until convergence.

D.2 Computation of Model with Aggregate Shocks

This appendix outlines the computation of the model with aggregate shocks. Consider an economy that starts from the steady state described above. Agents have perfect foresight but are surprised by unexpected shocks to ε_t^A and ε_t^R at $t = 0$, which agents expect to evolve as AR(1) processes from $t > 0$.

1. Set discrete grids on z^T . Set the Markov transition matrix for z^T . Set the distribution of the exit value x .
2. Choose a sufficiently long terminal horizon T , at which point the economy has reached steady state. Guess a path for $\{B_t\}_{t=1}^{T-1}$, with $B_t = \bar{B}$ for $t \geq T$. Given the path, compute $R_t = R \exp\left(\varepsilon_t^R - \vartheta \frac{B_t - \bar{B}}{\bar{B}Y}\right)$.
3. Solve for $e_t \lambda_t$. For $t \geq T$, $e_t \lambda_t = \lambda^{ss}$. For $t < T$, solve backwards using the Euler condition (7), $e_t \lambda_t = \beta R_t e_{t+1} \lambda_{t+1}$.
4. Guess a path for $\{W_t\}_{t=0}^{T-1}$. Note that $W_t = W^{ss}$ for $t \geq T$.
5. Solve for e_t using the exchange rate rule. Under the pure float ($\phi_w = 1$) the rule implies $W_t = W^{ss}$; the union's optimality condition then gives $\lambda_t = \lambda^{ss}$, and $e_t = (e_t \lambda_t) / \lambda^{ss}$ follows from step 3.
6. Otherwise, solve for λ_t given the solution to $e_t \lambda_t$ in step 3.
7. For each $t = T - 1, T - 2, \dots, 0$, guess a value for p_t^{max} :
 - (a) Solve for $p_t^k(\mu_t, z)$, $q_t^k(\mu_t, z)$ and $\pi_t^k(\mu_t, z)$, for $k = \{H, X, M\}$ and $z^P = \{z^L, z^H\}$, where $z = z^P z^{T'}$ is the idiosyncratic productivity realization in the current period and $\mu_t = \{W_t, p_t^{max}, Z_t^A\}$.
 - (b) Calculate $V_t^c(\mu_t, z^P, z^{T'})$ by

$$V_t^c(\mu_t, z^P, z^{T'}) = \begin{cases} \pi_t(\mu_t, z^P, z^{T'}) + \beta V_{t+1}(\mu_{t+1}, z^P, z^{T'}) & \text{if } \pi_t(\mu_t, z^P, z^{T'}) > 0, \\ 0 & \text{otherwise.} \end{cases}$$

- (c) Calculate $V_t(\mu_t, z^P, z^T)$ by

$$V_t(\mu_t, z^P, z^T) = \int \max \left\{ E_z \left[V_t^c(\mu_t, z^P, z^{T'}) \middle| z^T \right], x \right\} d\zeta(x),$$

where

$$E_z \left[V_t^c(\mu_t, z^P, z^{T'}) \middle| z^T \right] = \int V_t^c(\mu_t, z^P, z^{T'}) dH(z^{T'} | z^T).$$

Thus, the ratio of firms that exit with the state z is

$$\chi_t(\mu_t, z^P, z^T) = \int_{E_z[V_t^c(\mu_t, z^P, z^{T'})|z^T]}^\infty d\zeta(x).$$

(d) Now I can calculate

$$V_t^e(\mu_t, z^P, s) = \int V_t^c(\mu_t, z^P, z^{T'}) dH^s(z^{T'}|s),$$

for each s and solve for the cutoff $s_t^*(z^P)$ by setting $V_t^e(\mu_t, z^P, s_t^*(z^P)) = c_e$.

The measure of entrants is given by:

$$g_t(\mu_t, z^P, z^{T'}) = \int_{s_t^*(z^P)}^\infty \mathbf{1}\{\pi_t(\mu_t, z^P, z^{T'}) > 0\} H^s(z^{T'}|s) dS(s).$$

(e) Next, find

$$V_t^p(\mu_t) = \int \int \max \left\{ V_t^e(\mu_t, z^P, s) - c_e, 0 \right\} dS(s) dF(z^P).$$

(f) Check if free-entry condition is satisfied: $V_t^p(\mu_t) = c_s$. If not, revise the guess for p_t^{max} . Repeat until convergence.

8. Starting from the steady state distribution, simulate the measure of operating domestic firms forward.

(a) The measure of incumbents operating is:

$$\delta_t(\mu_t, z) \equiv \delta_t(\mu_t, z^P, z^{T'}) = H(z^{T'}|z^T)(1 - \chi_t(\mu_t, z^P, z^T))\gamma_{t-1}(\mu_{t-1}, z^P, z^T).$$

(b) The measure of operating domestic firms is

$$\gamma_t(\mu_t, z^P, z^{T'}) = \delta_t(\mu_t, z^P, z^{T'}) + M_t^s g_t(\mu_t, z^P, z^{T'}),$$

where the mass of potential entrants is held at its steady-state value, $M_t^s = M^s$, along the transition.

9. Calculate aggregate employment as

$$L_t = \int \int l_t(\mu_t, z) \gamma_t(\mu_t, z^P, z^{T'}) dz^{T'} dz^P \quad \text{where} \quad l_t(\mu_t, z) = \frac{W_t^{\sigma-1}}{Z_t^A z} \left(q_t^H(\mu_t, z) + \tau q_t^X(\mu_t, z) \right).$$

10. Calculate W_t^* as

$$W_t^* = \frac{\varepsilon_w}{\varepsilon_w - 1} \frac{\sum_{s=0}^\infty (\beta\theta)^s W_{t+s}^{\varepsilon_w} L_{t+s}}{\sum_{s=0}^\infty (\beta\theta)^s W_{t+s}^{\varepsilon_w} L_{t+s} \lambda_{t+s}}.$$

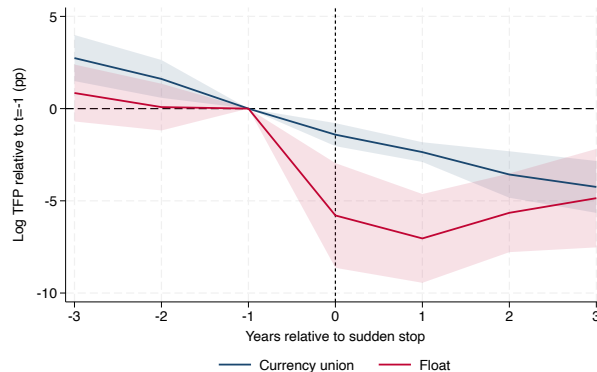
11. Calculate $W_t^{implied}$ from the aggregate wage dynamics equation:

$$W_t^{implied} = \left[\theta (W_{t-1}^{implied})^{1-\varepsilon_w} + (1-\theta)(W_t^*)^{1-\varepsilon_w} \right]^{\frac{1}{1-\varepsilon_w}}.$$

12. Compare $\{W_t^{implied}\}_{t=0}^{T-1}$ with the guess in step 4. If they are not close enough, update the guess and repeat steps 5–11 until convergence.
13. Calculate the implied path of foreign assets from the balance of payments, $e_t (B_t - R_{t-1}B_{t-1}) = NX_t$, where net exports NX_t are as defined in the equilibrium conditions above.
14. Compare $\{B_t^{implied}\}_{t=1}^{T-1}$ with the guess in step 2. If they are not close enough, update the guess and repeat steps 3–13 until convergence.

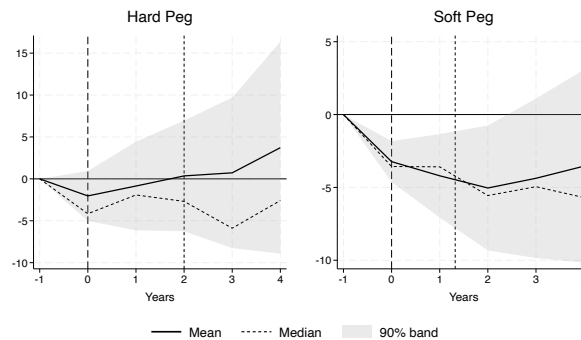
E Additional Figures

FIGURE A.1: PRODUCTIVITY AROUND A SUDDEN STOP IN RAW LEVELS



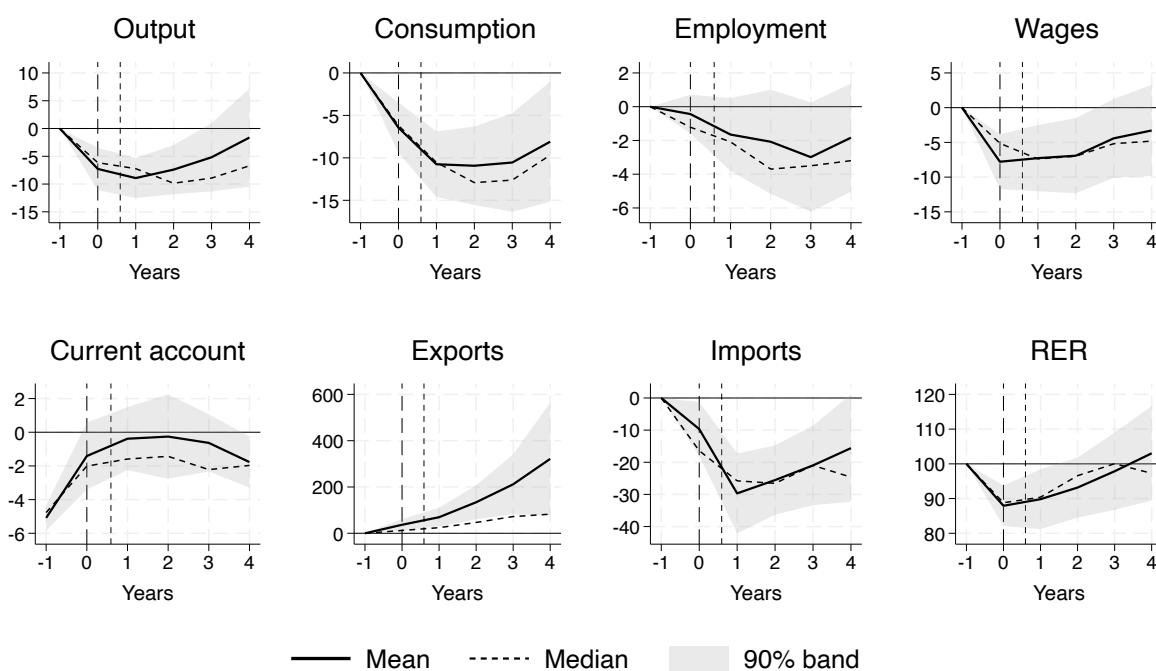
Notes: This figure plots the path of TFP around a sudden stop by exchange rate regime, contrasting currency unions (blue) with floats (red). Productivity is expressed in raw log points relative to $t = -1$, rather than as a deviation from trend. The solid line is the mean path and the shaded area is the 90% confidence band. The vertical line marks the start of the sudden stop ($t = 0$). The data used is collected from IFS, WDI and the Total Economy Database.

FIGURE A.2: PRODUCTIVITY DURING A SUDDEN STOP - HARD VERSUS SOFT PEGS



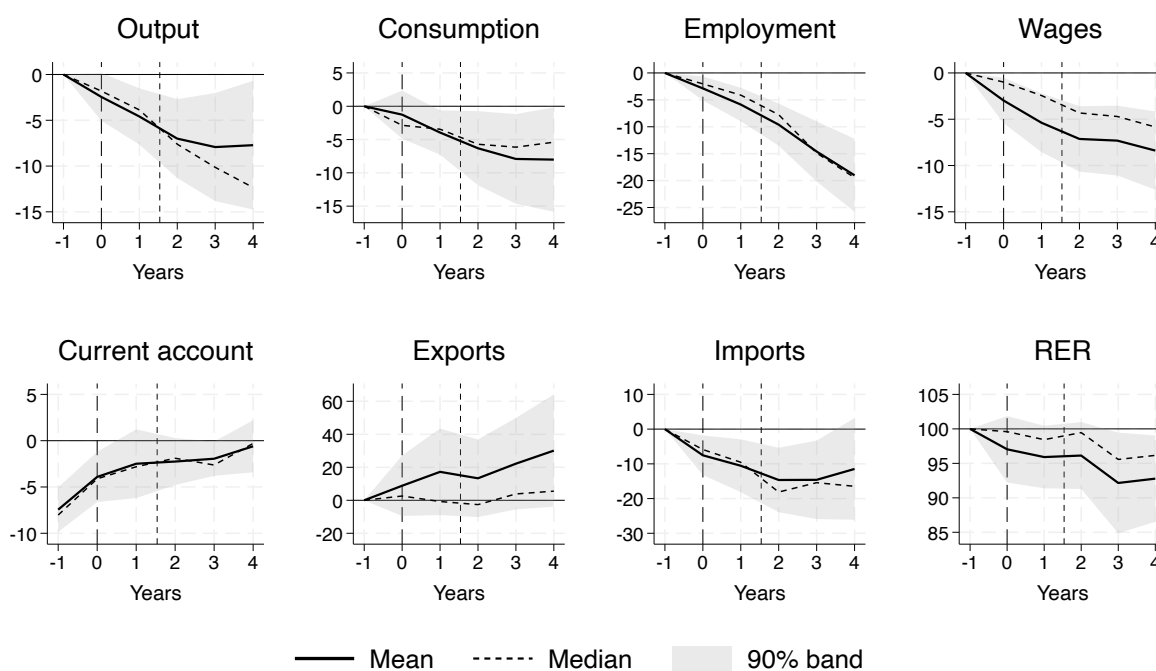
Notes: This figure plots the response of TFP to a sudden stop under a hard peg (left) and under a soft peg (right). The solid line is the mean and the dashed line the median path of productivity, while the shaded area is the 90% confidence band. The two vertical lines show the start and end of an average episode. Productivity is expressed as percentage deviations from an extrapolated linear trend fitted over the five-year pre-sudden-stop window. The data used is collected from IFS, WDI and the Total Economy Database.

FIGURE A.3: A SUDDEN STOP IN A FLOAT



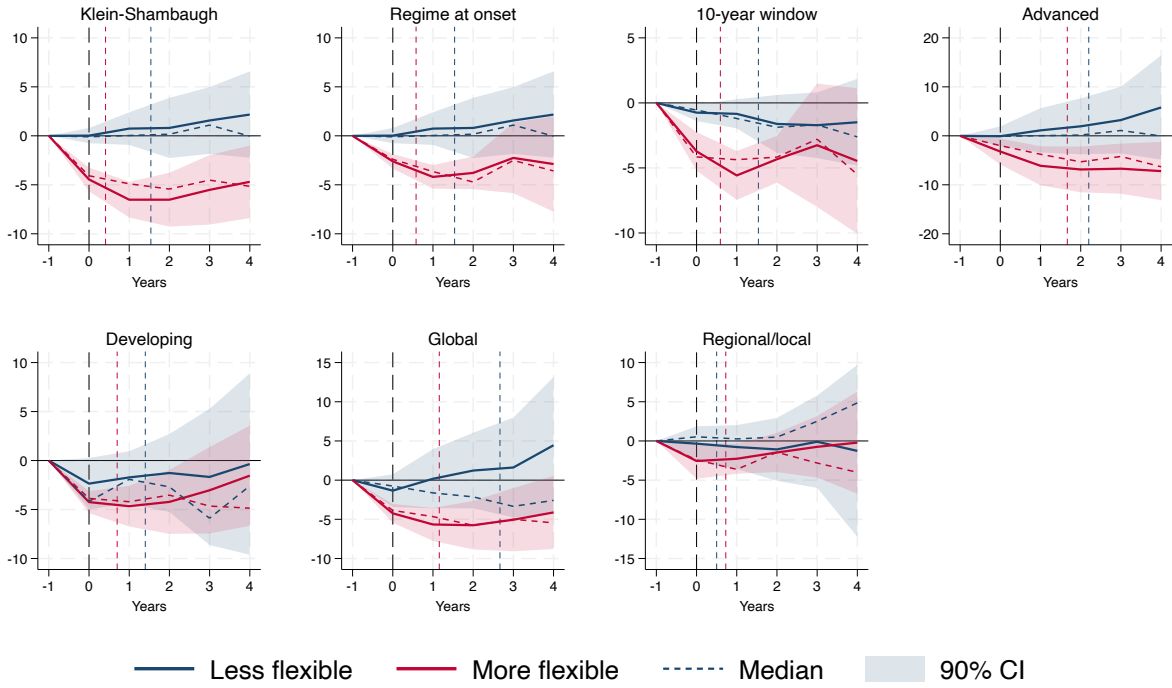
Notes: This figure plots the response of macroeconomic variables to a sudden stop under a float. The solid line is the mean and the dashed line the median path of the corresponding variables, while the shaded area is the 90% confidence band. The two vertical lines show the start and end of an average episode. Output, consumption, employment, wages, exports and imports are expressed in terms of percentage deviations from an extrapolated linear trend fitted over the five-year pre-sudden-stop window. Current account is expressed as a share of GDP and the real exchange rate (RER), calculated as an index, is expressed in levels. The data used is collected from IFS, WDI, the World Economic Outlook and the Total Economy Database, together with the Bruegel–Darvas real effective exchange rate database.

FIGURE A.4: A SUDDEN STOP IN A CURRENCY UNION



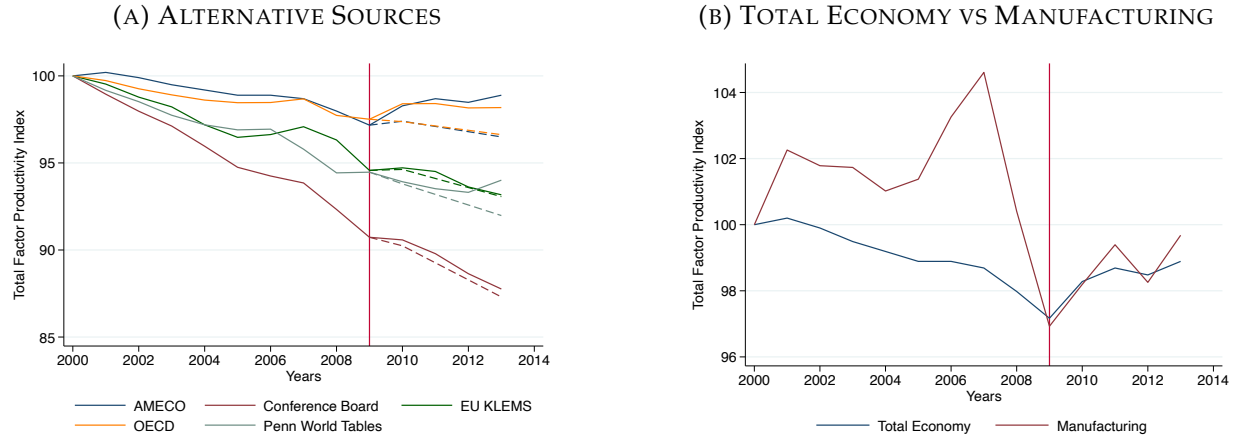
Notes: This figure plots the response of macroeconomic variables to a sudden stop under a currency union. The solid line is the mean and the dashed line the median path of the corresponding variables, while the shaded area is the 90% confidence band. The two vertical lines show the start and end of an average episode. Output, consumption, employment, wages, exports and imports are expressed in terms of percentage deviations from an extrapolated linear trend fitted over the five-year pre-sudden-stop window. Current account is expressed as a share of GDP and the real exchange rate (RER), calculated as an index, is expressed in levels. The data used is collected from IFS, WDI, the World Economic Outlook and the Total Economy Database, together with the Bruegel–Darvas real effective exchange rate database.

FIGURE A.5: PRODUCTIVITY DURING A SUDDEN STOP: ROBUSTNESS



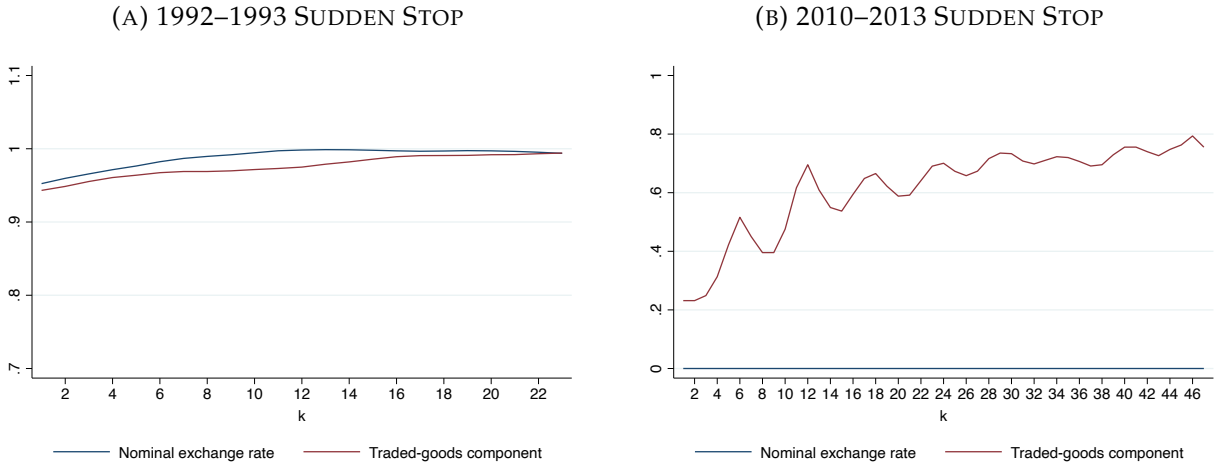
Notes: Each panel replicates the right panel of Figure I. In the first three panels, less flexible denotes currency unions and more flexible floats; in the rest, less flexible groups currency unions and hard pegs, and more flexible groups soft pegs and floats. In each panel the solid line is the mean and the dashed line the median path of productivity, while the shaded area is a 90% confidence band for the conditional mean, with standard errors clustered at the episode level. The vertical lines mark the start ($t = 0$) and the average end of an episode for each group. Productivity is expressed as percentage deviations from an extrapolated linear trend fitted over the five-year pre-sudden-stop window (ten years in the ten-year-window panel). The data used is collected from IFS, WDI and the Total Economy Database.

FIGURE A.6: TFP IN SPAIN



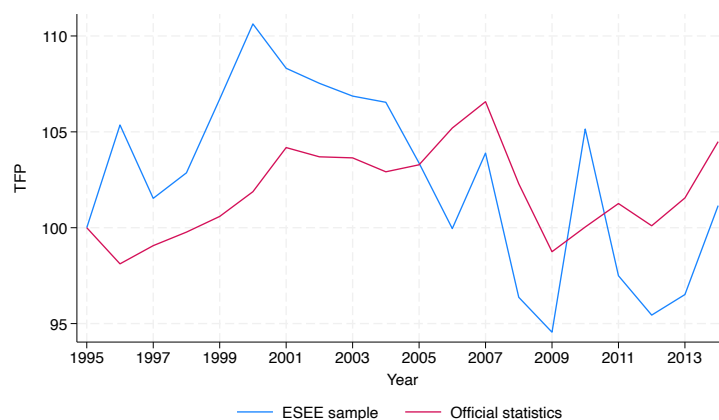
Notes: Panel (a) plots the evolution of aggregate TFP in Spain using alternative data sources. The solid line shows the observed series, while the dashed line corresponds to a quadratic trend extrapolated from pre-2009 data. Sources include AMECO, Conference Board, EU KLEMS, OECD, and Penn World Tables. Panel (b) compares the TFP index for the total economy (blue) and the manufacturing sector (red). Sources are AMECO and EU KLEMS.

FIGURE A.7: REAL EXCHANGE RATE DECOMPOSITION



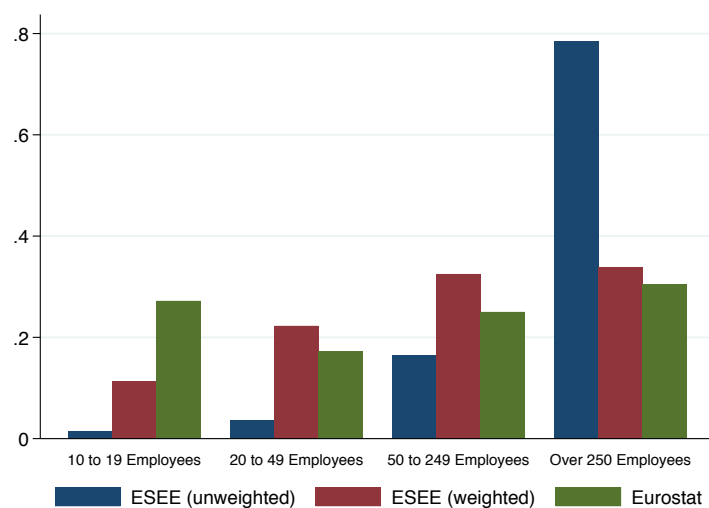
Notes: This figure applies the decomposition of Engel (1999) to the real exchange rate between Spain and Germany during two sudden stops. The real exchange rate is defined as $q_t = e_t + p_t^* - p_t$, where e_t is the log nominal exchange rate, p_t is the domestic price index, and p_t^* is the foreign price index. The figure plots the fraction of the mean squared error of $q_{t+k} - q_t$ attributed to the nominal exchange rate (blue) and to the traded-goods price component $x_t = e_t + p_t^* - p_t^T$ (red). The non-traded component is inferred as a residual using CPI and PPI data. Monthly data are from the Bank of Spain and IMF International Financial Statistics.

FIGURE A.8: MANUFACTURING TFP IN SPAIN - ESEE VS OFFICIAL STATISTICS



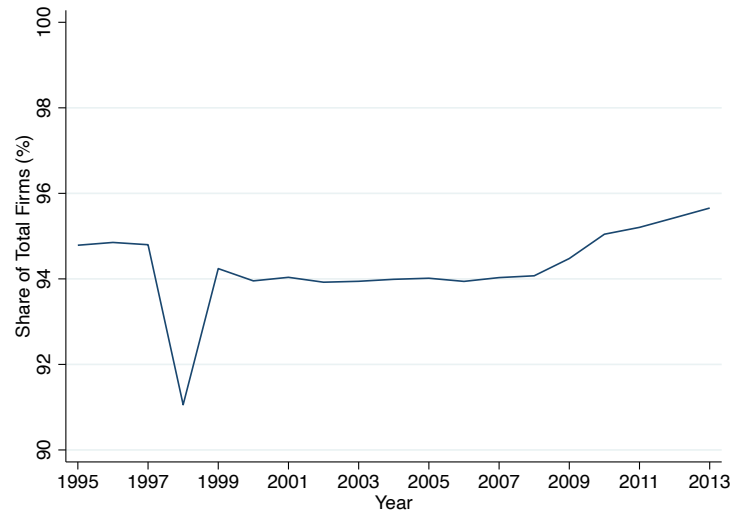
Notes: This figure plots the evolution of the TFP index in the ESEE sample (in blue) and the manufacturing sector according to official statistics (in red). The sources of the data are ESEE and EU Klems respectively.

FIGURE A.9: SHARE OF TOTAL EMPLOYMENT BY SIZE CLASS



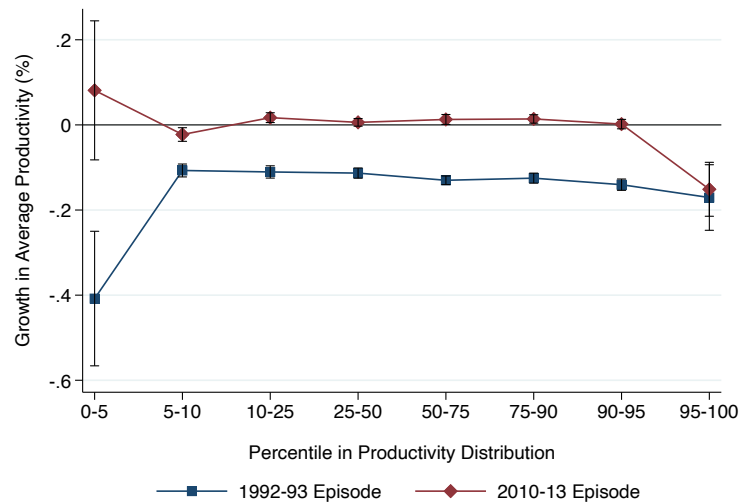
Notes: This figure plots the fraction of total employment accounted for by firms belonging to each size class. The blue and red bars report statistics from the ESEE dataset (unweighted and weighted correspondingly) and the green bar from Eurostat.

FIGURE A.10: EVOLUTION OF MICRO FIRMS IN SPAIN



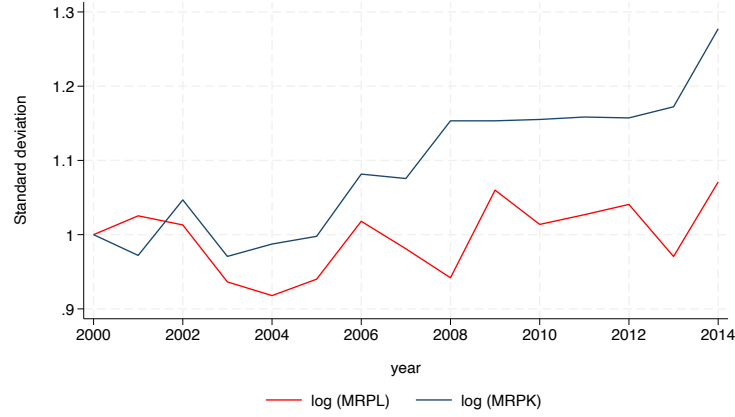
Notes: This figure plots the evolution of micro firms as a share of the total number of firms in the Spanish economy. Micro firms are defined as having less than ten employees. The data used is collected from the Spanish Business Registry (Directorio Central de Empresas, DIRCE).

FIGURE A.11: PRODUCTIVITY GROWTH ACROSS THE PRODUCTIVITY DISTRIBUTION



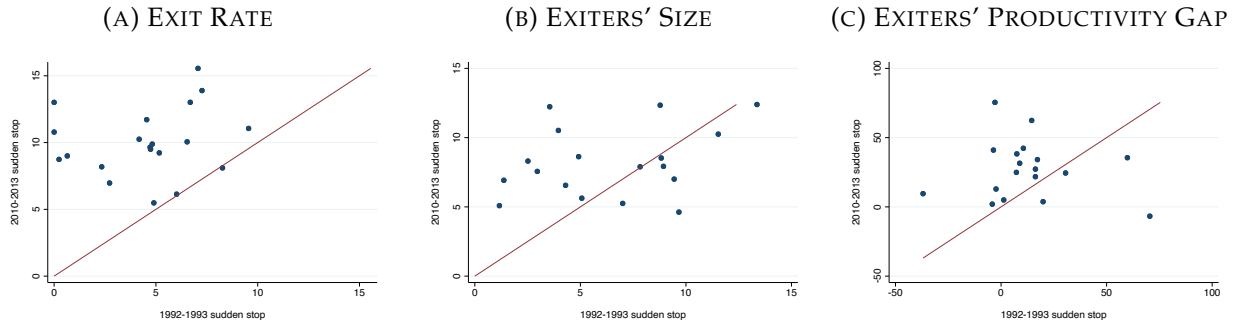
Notes: This graph plots the growth in average TFP by percentile of the productivity distribution. It compares the average TFP of firms in a given percentile before and after each of the two sudden stops. As this is an unbalanced panel, firms are allowed to change percentiles and even exit the sample during the transition. The corresponding base and end years are 1991 and 1993 for the first episode; 2009 and 2013 for the second episode. To account for variability, the vertical lines represent error bands. The data used is collected from the ESEE dataset.

FIGURE A.12: MISALLOCATION



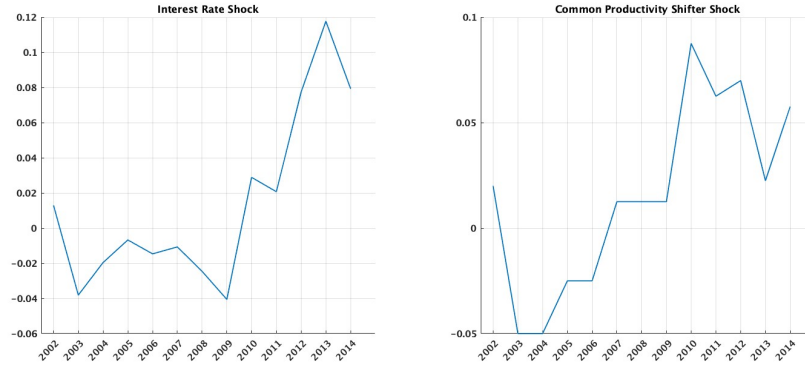
Notes: This figure plots within-industry dispersion of the marginal revenue products of capital (MRPK) and labor (MRPL) over time. Firm-level marginal revenue products are constructed following [Hsieh and Klenow \(2009\)](#), assuming a capital share of 0.35 and a constant markup of 1.5. Sector-level standard deviations (in logs) are aggregated using time-invariant employment weights based on average employment shares over 2000–2012. All series are normalized to one in 2000. Data source: ESEE.

FIGURE A.13: EXIT FEATURES BY SECTOR



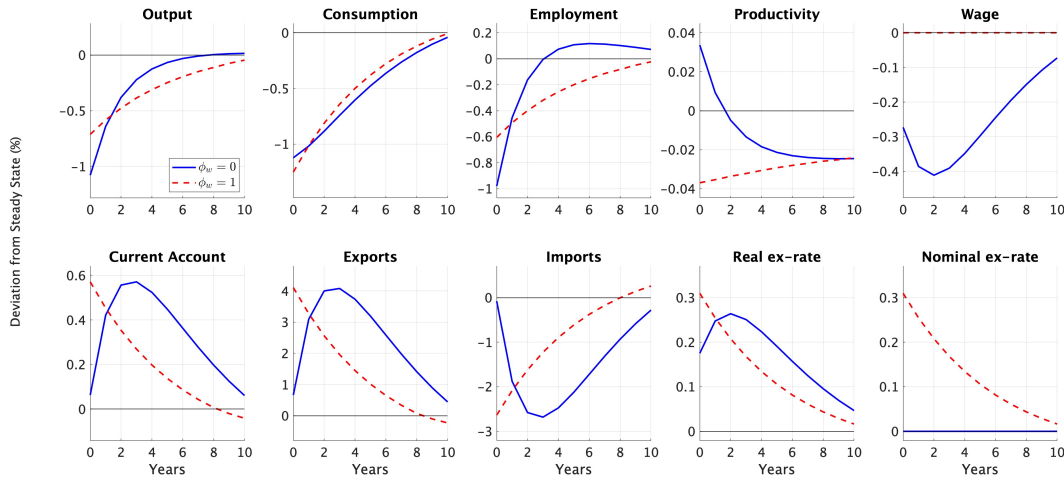
Notes: This figure plots the average exit rate, the average size of exiters, and the average productivity gap of exiters by industry for each sudden stop. The x-axis depicts the 1992–93 sudden stop while the y-axis depicts the 2010–13 sudden stop. Each dot represents a three-digit industry. Size is measured as the labor market share in the year prior to exit. The productivity gap is measured as the difference between incumbents' and exiters' average productivity in the year prior to exit. A 45-degree line is shown in red. Data source: ESEE.

FIGURE A.14: EVOLUTION OF SHOCKS



Notes. This figure plots the paths of the two aggregate shocks that I use to simulate the model. The left panel represents the interest rate shock, ε_t^R , and the right panel the common productivity shifter, ε_t^A .

FIGURE A.15: MACROECONOMIC EFFECTS OF A SUDDEN STOP - ALTERNATIVE NORMALIZATION



Notes. These figures plot the impulse response functions of key macroeconomic variables to a simultaneous increase in the interest rate and a decline in the common productivity shifter under a currency union ($\phi_w = 0$) and a float ($\phi_w = 1$), as predicted by the model described in Section 6. Under the currency union, the shocks correspond to a 1% cumulative increase in the interest rate and a 1% cumulative decrease in the common productivity shifter. Under the float, the interest rate shock is rescaled such that the peak current account adjustment, as a share of output, matches that of the currency union, instead of the peak real exchange rate depreciation as in Figure IV. All variables except the current account are expressed in percentage deviations from steady state. The current account is expressed as a share of output and shown in percentage point deviations from steady state. Exports and imports are denominated in domestic currency; output and consumption are expressed in real terms.

F Additional Tables

TABLE A.1: LIST OF SUDDEN STOPS

Country	Start Year	End Year	Exchange Rate	Country	Start Year	End Year	Exchange Rate
Albania	1991	1992	4	Macedonia FYR	2009	2010	2
Argentina	1995	1995	2	Malaysia	1998	1998	4
Argentina	1999	2002	4	Mali	1991	1991	1
Argentina	2014	2014	3	Mexico	1995	1995	4
Belarus	2014	2015	3	Moldova	1998	2003	3
Brazil	2015	2015	4	Moldova	2012	2013	3
Bulgaria	1991	1991	4	Morocco	1996	1996	3
Bulgaria	2009	2010	2	New Zealand	2004	2010	4
Chile	1999	1999	3	Nicaragua	1991	1991	2
Chile	2009	2010	4	Oman	1999	2000	2
Colombia	1998	1999	3	Oman	2010	2010	2
Croatia	1997	2002	2	Peru	1991	1991	4
Croatia	2009	2010	2	Philippines	1998	1998	4
Cyprus	2011	2011	1	Poland	1990	1990	4
Czech Rep.	1997	2002	3	Portugal	2001	2003	1
Czech Rep.	2008	2008	3	Portugal	2009	2013	1
Czech Rep.	2011	2013	3	Romania	1999	1999	4
Ecuador	1999	2000	0	Russia	1998	2002	3
Estonia	1996	2001	2	Rwanda	1994	1994	4
Estonia	2008	2009	2	Saudi Arabia	1992	1992	2
Ethiopia	1991	1991	3	Saudi Arabia	1999	2000	2
Ethiopia	2003	2003	3	Senegal	1994	1994	1
Finland	1991	1993	3	Sierra Leone	1996	1996	4
Finland	2013	2013	1	Slovak Republic	1997	2002	3
France	1991	1993	2	South Africa	2008	2008	4
Gabon	1999	1999	1	Spain	1993	1993	3
Greece	1993	1993	2	Spain	2009	2010	1
Greece	2009	2013	1	Spain	2012	2013	1
Haiti	2003	2003	4	Sri Lanka	2001	2001	3
Haiti	2009	2010	3	Sudan	2010	2010	3
Indonesia	1998	1998	4	Sweden	1991	1991	3
Iran	1992	1992	4	Sweden	2009	2010	3
Iran	1994	1995	4	Thailand	1997	1998	4
Ireland	2009	2014	1	Turkey	1994	1994	4
Israel	2001	2001	3	Turkey	2001	2001	4
Italy	1993	1994	3	Ukraine	1998	2003	2
Italy	2007	2007	1	Ukraine	2014	2015	4
Italy	2011	2014	1	United Kingdom	1990	1991	3
Kenya	1991	1992	4	United States	2007	2007	4
Korea	1997	1998	4	Uruguay	2001	2001	3
Latvia	2008	2009	3	Venezuela	1994	1994	4
Lithuania	1997	2002	2	Venezuela	1999	2000	3
Macedonia FYR	2000	2006	2	Yemen Rep. of	2009	2014	3

Notes: This table reports the list of sudden stops as identified by the algorithm described in Online Appendix A.2. Exchange rate is a categorical variable that refers to the exchange rate regime in place at the end of the sudden stop: currency union (=1), hard peg (=2), soft peg (=3), float (=4) and unclassified (=0). More details on the exchange rate classification are available in section 2. The data used is collected from the IMF's World Economic Outlook database and [Ilizetzki, Reinhart and Rogoff \(2019\)](#).

TABLE A.2: COMPOSITION OF MANUFACTURING OVER TIME

Industry	Output		Wage Bill	
	1993	2007	1993	2007
Chemical industry	0.10	0.10	0.10	0.08
Electrical and optical equipment	0.07	0.07	0.09	0.07
Food, beverages and tobacco	0.25	0.19	0.16	0.14
Machinery and equipment	0.05	0.06	0.07	0.08
Metallurgy and metal products	0.11	0.17	0.13	0.17
Non-metallic mineral products	0.06	0.08	0.07	0.08
Other manufacturing	0.03	0.03	0.04	0.05
Paper, publishing and printing	0.07	0.06	0.08	0.09
Rubber and plastics	0.04	0.04	0.05	0.05
Textile, clothing and leather	0.08	0.04	0.08	0.05
Transport equipment	0.13	0.15	0.12	0.11
Wood and cork industry	0.02	0.02	0.02	0.03

Notes: This table reports the share of output and wage bill across two-digit manufacturing sectors. Shares are computed over all manufacturing sectors and may not sum exactly to one due to rounding. The source of the data is the Industrial Companies Survey by activity sector, published by the Spanish National Institute of Statistics (INE)

TABLE A.3: ESEE COVERAGE OF THE MANUFACTURING SECTOR

Panel (a): Relative to 2007 EU Klems Release				Panel (b): Relative to 2016 EU Klems Release			
Year	Employment	Wage Bill	Value Added	Year	Employment	Wage Bill	Value Added
1990	0.08	0.10	0.09	1995	0.12	0.16	0.16
1991	0.10	0.13	0.11	1996	0.11	0.14	0.15
1992	0.11	0.15	0.13	1997	0.12	0.16	0.17
1993	0.11	0.15	0.13	1998	0.12	0.17	0.17
1994	0.12	0.16	0.15	1999	0.12	0.16	0.16
1995	0.12	0.15	0.15	2000	0.16	0.24	0.25
				2001	0.15	0.23	0.23
				2002	0.14	0.21	0.20
				2003	0.12	0.17	0.17
				2004	0.12	0.17	0.18
				2005	0.15	0.21	0.21
				2006	0.15	0.20	0.20
				2007	0.16	0.20	0.21
				2008	0.15	0.20	0.19
				2009	0.15	0.20	0.18
				2010	0.15	0.19	0.20
				2011	0.15	0.19	0.17
				2012	0.15	0.19	0.17
				2013	0.15	0.18	0.16
				2014	0.14	0.17	0.15

Notes: This table shows the coverage by year in employment, wage bill, and value added of the ESEE dataset relative to the aggregate data for Total Manufacturing reported by EU Klems. Panel (a) refers to the 2007 release, while Panel (b) focuses on the 2016 release.

TABLE A.4: EXTENSIVE MARGIN VALIDATION OF ESEE DATA

Panel (a): Over Time				
Year	Entry Rate		Exit Rate	
	DIRCE	ESEE	DIRCE	ESEE
1998	0.037	0.025	0.026	0.033
1999	0.030	0.031	0.027	0.029
2000	0.027	0.022	0.027	0.029
2001	0.023	0.024	0.023	0.026
2002	0.021	0.020	0.022	0.105
2003	0.019	0.021	0.020	0.003
2004	0.019	0.020	0.021	0.032
2005	0.015	0.036	0.019	0.031
2006	0.015	0.021	0.016	0.023
2007	0.014	0.004	0.017	0.020
2008	0.010	0.008	0.018	0.020
2009	0.009	0.011	0.025	0.026
2010	0.010	0.023	0.017	0.032
2011	0.010	0.004	0.018	0.033
2012	0.012	0.016	0.020	0.030
2013	0.014	0.020	0.020	0.029
Panel (b): By Sectors (Year 2007)				
Industry	DIRCE	ESEE	DIRCE	ESEE
Meat Products	0.010	0.020	0.012	0.011
Beverage	0.007	0.010	0.012	0.008
Textiles & Clothing	0.019	0.036	0.047	0.050
Leather, Fur & Footwear	0.037	0.051	0.062	0.080
Timber	0.011	0.017	0.015	0.028
Paper	0.007	0.003	0.007	0.006
Printing	0.013	0.025	0.013	0.010
Chemicals & Pharmaceuticals	0.011	0.021	0.008	0.016
Plastic & Rubber Products	0.011	0.014	0.015	0.034
Nonmetal Mineral Products	0.009	0.011	0.013	0.017
Basic Metal Products	0.016	0.024	0.011	0.016
Fabricated Metal Products	0.018	0.016	0.009	0.012
Machinery & Equipment	0.008	0.004	0.015	0.022
Computer Products, Electronics & Optical	0.003	0.006	0.013	0.017
Electric Materials	0.011	0.013	0.015	0.033
Vehicles	0.019	0.012	0.015	0.020
Other Transport Equipment	0.032	0.006	0.023	0.033
Furniture	0.011	0.010	0.016	0.024
Other Manufacturing	0.018	0.010	0.015	0.019

Notes: This table reports entry and exit rates of manufacturing firms with 10 or more employees, as measured by the Spanish Business Registry (Directorio Central de Empresas, DIRCE) and the ESEE dataset. Panel (a) reports rates over time across all sectors; Panel (b) reports sector-level rates for 2007.

TABLE A.5: FIRM CHARACTERISTICS PRE-SUDDEN STOP

	Mean _{SS1}	Mean _{SS2}	T-statistic
<i>Firm Characteristics</i>			
Age	16.96	26.91	-11.71***
Employment	49.14	51.61	-0.81
Sales	455.64	488.26	-0.68
Productivity Growth	-0.07	-0.11	1.57
Capital Intensity	0.89	0.89	-0.82
Leverage	0.15	0.15	0.09
Import Status	0.22	0.34	-5.92***
Export Status	0.25	0.39	-6.59***
<i>Share by Industry</i>			
Meat Products	0.02	0.04	-2.79***
Food & Tobacco	0.09	0.13	-2.62***
Beverage	0.01	0.03	-2.06**
Textiles & Clothing	0.12	0.07	4.18***
Leather, Fur & Footwear	0.05	0.03	1.97**
Timber	0.04	0.04	-0.48
Paper	0.02	0.02	0.40
Printing	0.07	0.05	1.30
Chemicals & Pharmaceuticals	0.05	0.05	-0.28
Plastic & Rubber Products	0.06	0.05	0.70
Nonmetal Mineral Products	0.06	0.07	-1.26
Basic Metal Products	0.01	0.03	-2.67***
Fabricated Metal Products	0.20	0.17	1.28
Machinery & Equipment	0.07	0.08	-0.64
Computer Products, Electronics & Optical	0.01	0.01	-1.69*
Electric Materials	0.03	0.02	2.01**
Vehicles	0.01	0.03	-3.01***
Other Transport Equipment	0.01	0.01	-1.58
Furniture	0.06	0.05	0.65
Other Manufacturing	0.02	0.02	1.04

Notes: This table characterizes firms exposed to each sudden stop, i.e., firms in years 1991 and 2009. *Sales* is normalized by GDP per capita. *Productivity Growth* corresponds to the percentage change of firm TFP between $t - 1$ and t . *Capital Intensity* is measured as the capital to output ratio. *Leverage* is measured as the bank debt-to-assets ratio. *Import Status* is a dummy equal to one if the firm reports imports above 50,000€ in value. *Export Status* is a dummy equal to one if the firm reports exports above 50,000€ in value. The sum of shares by industry is equal to one for each column. The t-statistic corresponds to a two-tailed t test; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.6: MOMENTS OF THE PRODUCTIVITY DISTRIBUTION

	1992-93 Episode		2010-13 Episode	
	Pre-sudden Stop	Sudden Stop	Pre-sudden Stop	Sudden Stop
Mean	0.31	0.17	0.12	0.13
Median	0.34	0.20	0.13	0.14
St. Dev.	0.61	0.64	0.71	0.66
Skewness	-0.40	-1.04	-2.21	-0.65
Kurtosis	6.12	9.14	24.98	6.40
Min	-3.37	-5.13	-9.00	-3.74
Max	2.73	2.76	2.75	3.58

Notes: This table summarizes moments of the distribution of firm-level TFP (in logs) before and after a sudden stop. The first two columns refer to the 1992-93 episode, while the last two focus on the 2010-13 episode. Pre-sudden stop measures are calculated using data from the year before the sudden stop starts. Sudden stop measures are calculated using data from the last year of the sudden stop. The data used is collected from the ESEE dataset.

TABLE A.7: DECOMPOSITION OF PRODUCTIVITY GROWTH - MATCHED DURATIONS

	Sudden Stops	
	1992-1993	2010-2011
Productivity Growth (%)	-12.96	3.23
Contribution to Productivity Growth		
Incumbents' Contribution	-13.37	0.09
Within-firm Contribution	-13.89	-2.67
Between-firm Contribution	-1.83	1.33
Cross-term Contribution	2.34	1.43
Net Entry Contribution	0.41	3.14
Entrants' Contribution	-1.81	-1.18
Exiters' Contribution	2.23	4.32

Notes: Productivity growth corresponds to the cumulative change in aggregate TFP over the stated periods. The decomposition follows the standard breakdown into incumbents (within-firm, between-firm, and cross-term components) and net entry (entrants and exiters). Contributions sum to total productivity growth. Details of the formal decomposition can be found in the main text. Source: ESEE.

TABLE A.8: ALTERNATIVE DECOMPOSITIONS OF PRODUCTIVITY GROWTH

	Baseline		FHK (2001)		MP (2015)	
	1992-93	2010-13	1992-93	2010-13	1992-93	2010-13
Productivity Growth (%)	-12.96	2.24	-12.96	2.24	-12.96	2.24
Contribution to Productivity Growth						
Incumbents' Contribution	-13.37	-4.54	-10.64	-2.96	-13.37	-4.54
Within-firm Contribution	-13.89	-7.36	-12.68	-5.23		
Between-firm Contribution	-1.83	0.32	-1.73	1.00		
Cross-term Contribution	2.34	2.50	3.77	1.28		
Shift Contribution					-14.04	-8.96
Reallocation Contribution					0.66	4.41
Net Entry Contribution	0.41	6.79	-2.32	5.20	0.41	6.79
Entrants' Contribution	-1.81	-0.40	-4.36	0.09	-1.81	-0.40
Exiters' Contribution	2.23	7.19	2.03	5.11	2.23	7.19

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 1991 and 1993 for the first episode; 2009 and 2013 for the second episode. Columns (2) and (3) correspond to the baseline decomposition as explained in the main text. Columns (4) and (5) correspond to the Foster, Haltiwanger and Krizan (2001) decomposition as given by: $\Delta Z_t = \sum_{i \in C} s_{i,t-1} \Delta Z_{i,t} + \sum_{i \in C} \Delta s_{i,t} (Z_{i,t-1} - Z_{t-1}) + \sum_{i \in C} \Delta s_{i,t} \Delta Z_{i,t} + \sum_{i \in N} s_{i,t} (Z_{i,t} - Z_{t-1}) - \sum_{i \in X} s_{i,t-1} (Z_{i,t-1} - Z_{t-1})$, where $s_{i,t}$ is the employment share and Z_{t-1} is the aggregate productivity level in period $t-1$. Columns (6) and (7) correspond to the Melitz and Polanec (2015) decomposition as given by: $\Delta Z_t = \Delta Z_t^C + \Delta \text{Cov}(s_{i,t}^C, Z_{i,t}^C) + s_t^N (Z_t^N - Z_t^C) - s_{t-1}^X (Z_{t-1}^X - Z_{t-1}^C)$, where Z_t^C is the unweighted mean change in the productivity of incumbents and $\text{Cov}(s_{i,t}^C, Z_{i,t}^C)$ is the covariance change between employment share and productivity for incumbents. The data used is collected from the ESEE dataset.

TABLE A.9: DECOMPOSITION OF PRODUCTIVITY GROWTH USING ALTERNATIVE WEIGHTS

	Baseline		Value-added		Sales	
	1992-1993	2010-2013	1992-1993	2010-2013	1992-1993	2010-2013
Productivity Growth (%)	-12.96	2.24	-10.48	5.63	-8.97	2.67
Contribution to Productivity Growth						
Incumbents' Contribution	-13.37	-4.54	-11.46	1.75	-10.73	-2.51
Within-firm Contribution	-13.89	-7.36	-21.95	-22.21	-15.12	-9.91
Between-firm Contribution	-1.83	0.32	-10.34	-6.28	-1.31	-1.01
Cross-term Contribution	2.34	2.50	20.83	30.24	5.69	8.41
Net Entry Contribution	0.41	6.79	0.98	3.89	1.77	5.17
Entrants' Contribution	-1.81	-0.40	-0.70	-1.96	-0.69	-1.40
Exiters' Contribution	2.23	7.19	1.68	5.85	2.46	6.57

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 1991 and 1993 for the first episode; 2009 and 2013 for the second episode. Columns (2) and (3) correspond to the baseline decomposition as explained in the main text. Columns (4) and (5) use value-added weights while columns (6) and (7) use sales weights.

TABLE A.10: REALLOCATION AND PRODUCTIVITY RANKS

	Exit				Labor Growth							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
r_{it}	-0.067*** (0.007)	-0.059*** (0.007)	-0.068*** (0.007)	-0.066*** (0.007)	-0.067*** (0.007)	-0.058*** (0.007)	0.071*** (0.006)	0.070*** (0.007)	0.072*** (0.006)	0.068*** (0.006)	0.069*** (0.006)	0.066*** (0.007)
$ss^1_{t+1} * r_{it}$	0.028 (0.018)	0.015 (0.019)	0.025 (0.018)	0.028 (0.018)	0.028 (0.018)	0.009 (0.020)	-0.015 (0.018)	-0.010 (0.019)	-0.011 (0.018)	-0.016 (0.018)	-0.013 (0.018)	-0.020 (0.020)
$ss^2_{t+1} * r_{it}$	-0.077*** (0.016)	-0.056*** (0.016)	-0.066*** (0.016)	-0.074*** (0.016)	-0.072*** (0.016)	-0.044** (0.016)	0.039*** (0.013)	0.034*** (0.013)	0.039*** (0.014)	0.034*** (0.014)	0.030*** (0.013)	0.025** (0.013)
$leverage_{it}$		0.050*** (0.013)				0.043*** (0.013)		0.023*** (0.010)				0.025*** (0.010)
$ss^1_{t+1} * leverage_{it}$		-0.006 (0.037)				0.015 (0.037)		0.026 (0.037)				0.009 (0.038)
$ss^2_{t+1} * leverage_{it}$		0.056* (0.031)				0.034 (0.031)		-0.034 (0.027)				-0.033 (0.026)
$highrate_{it}$			0.019*** (0.006)			0.015** (0.007)			-0.011*** (0.005)			-0.008** (0.004)
$ss^1_{t+1} * highrate_{it}$			-0.023 (0.022)			-0.028 (0.023)			-0.024* (0.013)			-0.030* (0.016)
$ss^2_{t+1} * highrate_{it}$			0.055*** (0.015)			0.047*** (0.015)			-0.008 (0.013)			-0.010 (0.013)
$importer_{it}$				-0.010*** (0.003)		-0.010** (0.004)			0.019*** (0.003)			0.016*** (0.003)
$ss^1_{t+1} * importer_{it}$				0.001 (0.013)		0.010 (0.014)			0.011 (0.013)			0.022 (0.017)
$ss^2_{t+1} * importer_{it}$				-0.011 (0.009)		0.003 (0.010)			0.022*** (0.007)			0.006 (0.009)
$exporter_{it}$					0.000 (0.003)	0.003 (0.004)				0.013*** (0.004)		0.006 (0.004)
$ss^1_{t+1} * exporter_{it}$					-0.020** (0.009)	-0.026* (0.012)				0.009 (0.012)		-0.002 (0.015)
$ss^2_{t+1} * exporter_{it}$					-0.021** (0.007)	-0.014* (0.009)				0.038*** (0.006)		0.034*** (0.008)
Observations	36,252	34,279	34,808	36,252	36,252	33,759	32,262	30,562	30,883	32,262	32,262	30,098
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reproduces Table III replacing log productivity with r_{it} , the firm's percentile in the distribution of TFP_{it} within its three-digit industry and year. Because TFP is a strictly monotone transformation of TFPQ within each industry-year, r_{it} is identical under either measure, so the estimates are invariant to the TFP/TFPQ distinction. Columns (1) to (6) report linear probability models where $exit=1$ if a firm that operates in period t exits the market in period $t+1$. Columns (7) to (12) report regressions for labor growth, measured from period t to period $t+1$. ss_{t+1}^1 is a dummy equal to one for years 1992-93 and ss_{t+1}^2 is a dummy equal to one for years 2010-13. $leverage_{it}$ is the bank debt-to-assets ratio. $highrate_{it}$ is a dummy equal to one if the firm's average interest rate on long-term bank debt is in the top quartile of the distribution among indebted firms in that year, a proxy for a high borrowing cost or default risk. $importer_{it}$ ($exporter_{it}$) is a dummy equal to one if the firm reports imports (exports) above 50,000€. Firm controls in period t account for age and size effects. Standard errors (in parentheses) are calculated using bootstrapping methods, recomputing r_{it} within each bootstrap sample; significance levels are based on bootstrap percentile confidence intervals; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.11: PRODUCTIVITY GROWTH DECOMPOSITION 2010-13 - TFPR ROBUSTNESS

	Data	TFPQ		TFPR	
		Currency Union	Float	Currency Union	Float
Productivity Growth (%)	2.24	6.52	-2.29	6.43	-2.26
Incumbents' Contribution	-4.54	4.45	-4.12	5.32	-3.22
Within-firm Contribution	-7.36	-5.65	-5.13	-3.88	-8.61
Between-firm Contribution	0.32	10.94	-2.35	10.05	0.06
Cross-term Contribution	2.50	-0.84	3.37	-0.85	5.33
Net Entry Contribution	6.79	2.07	1.83	1.12	0.96
Entrants' Contribution	-0.40	-1.85	-0.41	-0.81	-0.22
Exiters' Contribution	7.19	3.92	2.24	1.93	1.18

Notes: This table reports the decomposition of productivity growth in Spain over the period 2010–2013. Column 1 repeats the empirical results shown in Table II. Columns 2 and 4 show the model's baseline simulation under a currency union, and columns 3 and 5 report a counterfactual scenario in which Spain operates under a flexible exchange rate regime and is exposed to the same sequence of shocks as in the baseline. Columns 2 and 3 measure productivity with physical productivity (TFPQ). Columns 4 and 5 use revenue productivity (TFPR), defined as TFPQ times the firm's average revenue per unit of output (domestic sales plus exports valued at the real exchange rate) and deflated by the economy-wide average revenue price, which mirrors the use of industry-deflated value added in the data. All figures are expressed in percentage points.

TABLE A.12: DECOMPOSITION OF PRODUCTIVITY GROWTH USING ORBIS

	Czech Republic 2011-2013	Spain 2010-13
Productivity Growth (%)	-7.18	8.83
Contribution to Productivity Growth		
Incumbents' Contribution	1.20	2.20
Within-firm Contribution	-2.72	-1.28
Between-firm Contribution	3.27	1.89
Cross-term Contribution	0.65	1.59
Net Entry Contribution	-8.38	6.63
Entrants' Contribution	-6.14	-0.19
Exiters' Contribution	-2.24	6.82

Notes: Productivity growth refers to accumulated TFP growth for the stated period. Base and final years are 2010 and 2013 for the Czech Republic sudden stop and 2009 and 2013 for the Spanish sudden stop. Contribution of incumbents and net entrants add up to productivity growth. Contribution of within-firm, between-firm and cross-term components add up to incumbents' contribution. Contribution of entrants and exiters add up to net entry contribution. Details of the formal decomposition can be found in Online Appendix C.6. The data used is collected from ORBIS.

TABLE A.13: REALLOCATION AND PRODUCTIVITY USING ORBIS

	Spain			Czech Republic		
	Exit (1)	Labor Growth (Incumbents & Exiters) (2)	Labor Growth (Incumbents Only) (3)	Exit (4)	Labor Growth (Incumbents & Exiters) (5)	Labor Growth (Incumbents Only) (6)
TFP_{it}	-0.049** (0.017)	0.033*** (0.005)	0.026*** (0.007)	-0.003*** (0.001)	0.047*** (0.008)	0.047*** (0.008)
$ss_{t+1} \times TFP_{it}$	-0.060*** (0.021)	-0.005 (0.007)	0.001 (0.010)	0.004*** (0.001)	0.032*** (0.007)	0.032*** (0.007)
Observations	43,286	26,435	17,204	77,967	60,340	60,118
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regression for exit is a linear probability model where exit=1 if a firm that operates in period t exits the market in period $t + 1$. Labor growth is measured from period t to period $t + 1$. TFP_{it} is the log firm-level TFP at time t and ss_{t+1} is a dummy equal to one for years 2010-13 in regressions (1)-(3) and years 2011-13 in regressions (4)-(6). Firm controls in period t account for age and size effects. Standard errors (in parentheses) are clustered using bootstrapping methods; significance levels are based on bootstrap percentile confidence intervals; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.14: FIRM EXIT AND PRODUCTIVITY WITH ADDITIONAL CONTROLS USING ORBIS

	Spain		Czech Republic	
	(1)	(2)	(3)	(4)
TFP_{it}	-0.049** (0.017)	-0.044* (0.020)	-0.003*** (0.001)	-0.003*** (0.001)
$ss_{t+1} * TFP_{it}$	-0.060*** (0.021)	-0.082*** (0.024)	0.004*** (0.001)	0.003*** (0.001)
$leverage_{it}$		0.017*** (0.004)		0.002*** (0.001)
$ss_{t+1} * leverage_{it}$		0.000 (0.008)		-0.002** (0.001)
Observations	43,286	25,751	77,967	77,967
Industry-Year FE	Yes	Yes	Yes	Yes
Firm Controls FE	Yes	Yes	Yes	Yes

Notes: All regressions are linear probability models where exit=1 if a firm that operates in period t exits the market in period $t + 1$. TFP_{it} is the log firm-level TFP at time t and ss_{t+1} is a dummy equal to one for years 2010-13 in regressions (1)-(2) and years 2011-13 in regressions (3)-(4). $leverage_{it}$ is captured by the debt-to-assets ratio. Firm controls in period t account for age and size effects. Standard errors (in parentheses) are clustered using bootstrapping methods; significance levels are based on bootstrap percentile confidence intervals; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.15: FIRM EXIT AND PRODUCTIVITY WITH ADDITIONAL CONTROLS

	(1)	(2)	(3)	(4)	(5)	(6)
TFP_{it}	-0.038*** (0.005)	-0.038*** (0.005)	-0.039*** (0.005)	-0.038*** (0.005)	-0.038*** (0.005)	-0.037*** (0.005)
$ss_{t+1}^1 * TFP_{it}$	0.007 (0.013)	0.006 (0.013)	0.006 (0.013)	0.007 (0.013)	0.004 (0.013)	0.005 (0.012)
$ss_{t+1}^2 * TFP_{it}$	-0.052*** (0.011)	-0.052*** (0.011)	-0.052*** (0.011)	-0.050*** (0.011)	-0.050*** (0.011)	-0.051*** (0.011)
$temporary_{it}$		-0.008 (0.008)			-0.009 (0.008)	-0.011 (0.008)
$ss_{t+1}^1 * temporary_{it}$		0.031** (0.019)			0.027 (0.018)	0.020 (0.020)
$ss_{t+1}^2 * temporary_{it}$		-0.010 (0.027)			-0.012 (0.027)	-0.020 (0.027)
$unskilled_{it}$			-0.020 (0.017)		-0.022 (0.017)	-0.026* (0.017)
$ss_{t+1}^1 * unskilled_{it}$			-0.027 (0.093)		-0.030 (0.096)	-0.041 (0.099)
$ss_{t+1}^2 * unskilled_{it}$			0.031 (0.037)		0.021 (0.037)	0.027 (0.038)
$expshare_{it}$				0.002 (0.007)	0.001 (0.007)	-0.001 (0.008)
$ss_{t+1}^1 * expshare_{it}$				-0.048** (0.026)	-0.046* (0.027)	-0.040* (0.028)
$ss_{t+1}^2 * expshare_{it}$				-0.027* (0.018)	-0.026* (0.018)	-0.028* (0.019)
$impshare_{it}$				-0.024 (0.015)	-0.027* (0.016)	-0.023 (0.016)
$ss_{t+1}^1 * impshare_{it}$				0.016 (0.053)	0.014 (0.054)	0.018 (0.056)
$ss_{t+1}^2 * impshare_{it}$				-0.017 (0.032)	-0.016 (0.032)	-0.011 (0.033)
Observations	36,252	36,248	35,959	36,252	35,955	35,953
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year FE	No	No	No	No	No	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All regressions are linear probability models where $exit=1$ if a firm that operates in period t exits the market in period $t+1$. TFP_{it} is the log firm-level TFP at time t , ss_{t+1}^1 is a dummy equal to one for years 1992-93 and ss_{t+1}^2 is a dummy equal to one for years 2010-13. $temporary_{it}$ is the share of temporary workers in total employment. $unskilled_{it}$ is the share of workers without a degree. $expshare_{it}$ ($impshare_{it}$) is the value of exports (imports) over sales. Column (6) adds region-year fixed effects, where regions are the seventeen Spanish autonomous communities, on top of the industry-year fixed effects included throughout. Firm size classes and a young-firm indicator in period t are included in every column. Standard errors (in parentheses) are calculated using bootstrapping methods; significance levels are based on bootstrap percentile confidence intervals; *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

TABLE A.16: SELECTION AT EXIT ACROSS PERIODS

	Currency	Sudden stop?	Exit-productivity coefficient
1992–93	peseta	Yes	-0.031*** (0.012)
1994–98	peseta	No	-0.032*** (0.010)
1999–2007	euro	No	-0.038*** (0.007)
2008–09	euro	No	-0.054*** (0.016)
2010–13	euro	Yes	-0.090*** (0.010)
<i>Tests of equality of coefficients</i>			
1994–98 = 1999–2007	<i>(the euro-era placebo)</i>		0.74
1999–2007 = 2008–09			0.36
2008–09 = 2010–13			0.08
1999–2007 = 2010–13			<0.02
1992–93 = 2010–13			<0.02
Observations	31,334		
Industry-Year FE	Yes		
Firm Controls	Yes		

Notes: The table reports coefficients on TFP_{it} interacted with period indicators from a linear probability model of firm exit. A more negative coefficient indicates stronger selection at exit. Periods are defined on $t + 1$. All specifications include industry-year fixed effects, firm size classes, and a young-firm indicator. Standard errors and p -values for the equality tests are obtained from 100 bootstrap resamples. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

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